A COMPARATIVE STUDY OF EQUAL DOSES OF INTRATHECAL ISOBARIC BUPIVACAINE AND ISOBARIC ROPIVACAINE FOR LOWER LIMB SURGERIES AND PERINEAL SURGERIES

A STUDY OF 100 CASES

DISSERTATION SUBMITTED FOR THE DEGREE OF

DOCTOR OF MEDICINE

BRANCH – X (ANAESTHESIOLOGY)

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CONTENTS

INTRODUCTION

"Spinal Anaesthesia" plays an important role in alleviating pain intraoperatively.

The term "Spinal Anaesthesia" was coined by J. Leonard Corning in 1885.

In 1898, the first deliberate spinal anaesthesia was given to August Karl Gustav Bier by his assistant Dr.Hildebrandt. The second attempt was done on the theca of Dr.Hildebrandt. Twenty three minutes after the injection of cocaine, Dr. Bier noted "A strong blow with an iron hammer against the tibia was not felt as pain."

First planned spinal analgesia was performed by Bier on 16th August 1898, in Kiel, when he injected 3 ml of 0.5% cocaine solution to a 34 year old labourer.

This was followed by successful and enthusiastic practice of spinal anaesthesia by "Rudolp Matas' in New Orleans and "Theodore Tuffier"in France.

For lower extremity and perineal surgeries the standard and most frequently employed technique is subarachnoid block. It provides superior analgesia and reduces perioperative complications (eg. Nausea, vomiting, dizziness, lethargy) compared with general anesthesia.

Injection Lignocaine, Bupivacaine (isobaric and hyperbaric) Ropivacaine (isobaric and hyperbaric) are the common drugs used for spinal anaesthesia.

Lignocaine has faster onset and short duration of sensory and motor block which is ideal for short procedures (1 – 1 ½ hrs). The disadvantage of it, is the hypotension and bradycardia which occurs soon after subarachnoid block and transient neurological symptoms.

Short acting local anaesthetics such as plain 2-chloroprocaine have been used with success for surgical procedures lasting an hour or less, with no reports of transient neurological symptoms.

Bupivacaine is the commonly used drug, which is of intermediate to long duration. But in the ambulatory anaesthesia, usage of Bupivacaine is disadvantageous because of residual motor and sympathetic blockade which can delay discharge, delayed ambulation and urinary retention.

So for a long time a suitable alternative to Bupivacaine was on research and Ropivacaine was introduced. It is available as isobaric solution and can be made hyperbaric by adding dextrose.

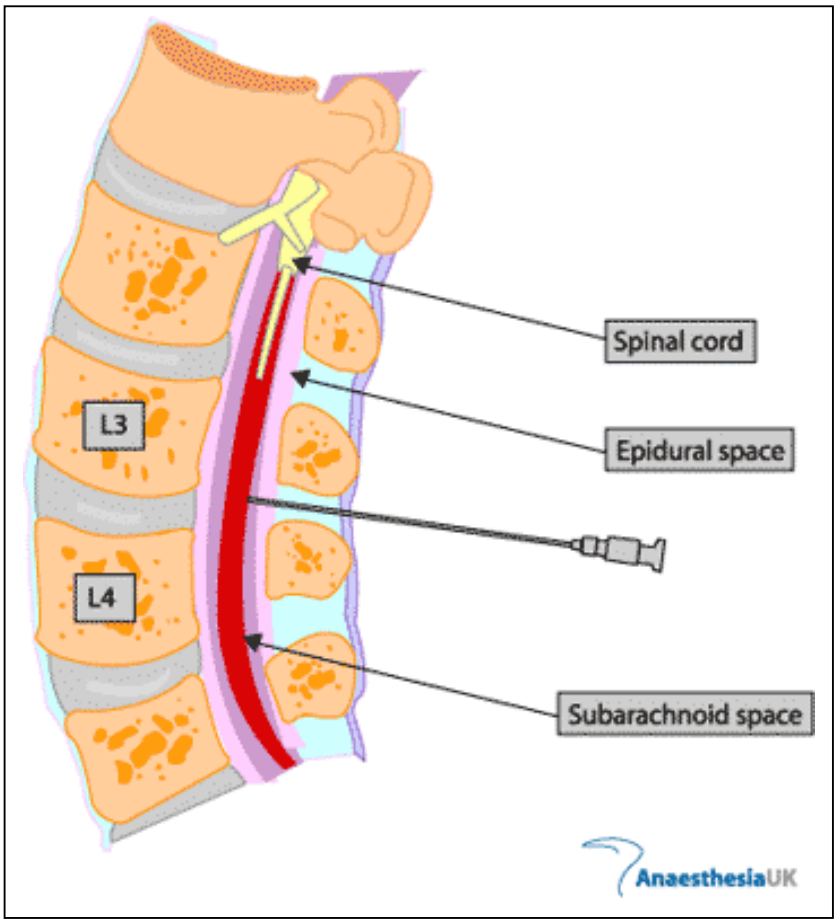
The duration of onset of sensory block, onset of motor block and highest sensory level reached, are longer but the offset of sensory and motor block, two segment regression time and the time of urination are shorter for Ropivacaine. The lower lipid solubility of Ropivacaine is the cause for delayed onset of sensory block. Ropivacaine has a good hemodynamic stability. Cardiovascular and central nervous system toxicity are less in Ropivacaine when compared to Bupivacaine.

Hence this study, is to evaluate the effect of equal doses of intrathecal isobaric Bupivacaine and isobaric Ropivacaine in terms of duration of analgesia and changes in hemodynamic variables.

AIM OF STUDY

The aim of this study is to evaluate the effect of equal doses of intrathecal isobaric Bupivacaine and isobaric Ropivacaine in terms of duration of analgesia and haemodynamic parameters.

ANATOMY OF SPINAL CORD



ANATOMY OF SUBARACHNOID SPACE

Subarachnoid block means the temporary interruption of nerve transmission within the subarachnoid space produced by injection of a local anaesthetic solution into cerebrospinal fluid.

Applied anatomy of vertebral canal:

Vertebral canal extends from foramen magnum to the sacral hiatus.

It protects the spinal cord.

The vertebral column comprises 33 vertebrae (7-cervical, 12-thoracic, 5-lumbar, 5-fused sacral and 4-coccygeal) has four curves. Cervical and lumbar curves are convex anteriorly and thoracic & sacral curves are convex posteriorly. The curves of the vertebral column influences the spread of the local anaesthetic in the subarachnoid space.

Each vertebra is composed of a body separated from the adjacent vertebra by intervertebral disc and formed by pedicles and laminae, which surround and protect the cord laterally and posteriorly.

The vertebral column is bound together by several ligaments. They are,

1. Supraspinal ligament – passes longitudinally over the tips of the spinous processes from C7 to the sacrum.
2. Interspinous ligament – connects the adjoining spinous processes together.
3. Ligamentum Flavum – composed of yellow elastic fibres known as yellow ligament, connects the adjacent laminae. They become progressively thicker from above downwards.
4. Posterior longitudinal ligament – It is on the posterior surface of bodies of vertebrae.
5. Anterior longitudinal ligament – It runs along the front of the vertebral bodies.

Vertebral canal formed by these structures has deficiencies posteriorly in the midline called inter laminar foramina which enlarges in flexion is accessible for the passage of spinal needle. The direction of spinous process determine the direction of spinal needle.

SPINAL CORD:

It is the direct continuation of the medulla oblongata extending from the upper border of the atlas to the first lumbar vertebra below which there is leash of nerve roots termed cauda equina. Spinal nerves are 31 pairs totally.

8 – Cervical

12 – Thoracic

5 – Lumbar

5 – Sacral

1 – Coccygeal

Each of the spinal nerve is composed of anterior and posterior roots uniting at the inter vertebral foramina and form a nerve trunk. Membranes covering the spinal cord are dura mater, arachnoid mater and piamater. Dura and arachnoid mater end at S_2 level. Piamater is closely adjacent to the spinal cord.

BLOOD SUPPLY:

It is from the anterior spinal artery which is a branch of vertebral artery and also by a pair of posterior spinal arteries which arise from the posterior inferior cerebellar arteries. The anterior and posterior spinal arteries receive additional blood flow from the intercostals arteries in the thorax and lumbar arteries. One of these radicular arteries is typically large, the artery of Adamkiewicz.

SPINAL VEINS:

The spinal veins are arranged into anterior and posterior plexus which are draining into vertebral, azygos and lumbar veins.

CEREBROSPINAL FLUID:

This is an ultrafiltrate of the blood plasma from choroid plexus of the lateral ventricles with a pH of 7.32 (7.27-7.37)

It is a clear, colourless fluid found in the cranial and spinal subarachnoid spaces and in the ventricles of the brain.

The total volume of CSF in an average adult ranges from 120-150ml of which 25-35ml is in the spinal subarachnoid space.

Composition of cerebrospinal fluid:

Specific gravity	-	1.006 (1.003-1.009) at 37^0C
Pressure	-	60-80mm of water
PCO_2	-	48mmHg
$HCO3^-$	-	23meq/l
Na^+	-	133-145meq/l
Ca^+	-	2-3meq/l
$PO4^-$	-	1.6mg/dl
Mg^+	-	2-2.5mg/dl
Cl^-	-	15-20mg/dl
Protein	-	23-38mg/dl
Sugar	-	45-80mg/dl

Lymphocytes - 0-5cells/cmm

BARICITY

Baricity plays an important role in spread of local anaesthetic in the spinal space. Baricity of spinal anaesthetic solution is a ratio : the density of local anaesthetic divided by density of CSF both at 37 degree centigrade. Local anaesthetics can be hyperbaric ,hypobaric or isobaric, when compared to CSF.

The anesthetic solution is said to be hyperbaric when baricity is more than 1.008 gm/ml ,isobaric when baricity is between 0.9980 – 1.0080 gm / ml, hypobaric when baricity is less than 0.9970 g / ml. Hyperbaric solutions are prepared by adding dextrose, isobaric is a plain drug, hypobaric by adding water.

	Density	Baricity
Water	0.9933	0.9930
CSF	1.0003	1.0000
Isobaric		
Lignocaine 2%	1.0004	1.0003
Bupivacaine 0.5%	0.9993	0.9990
Ropivacaine 0.5%	0.9995	0.9988
Hyperbaric		
Lignocaine 5% in dexrose7.5%	1.0265	1.0265
Bupivacaine 0.5%with dextrose 8 %	1.0210	1.0207

Hypobaric solutions are less dense than CSF and tend to rise against gravity which leads to higher spread.

Isobaric solutions are as dense as CSF and tend to remain at the level at which they are injected. Cephalad movement is due to bulk movement of CSF which carries any drug injected intrathecally.Hyperbaric solutions are more dense than CSF and tend to follow gravity after injected. So, positioning soon after performing the spinal anaesthesia is important.

PHYSIOLOGY OF SUBARACHNOID BLOCK

Subarachnoid block implies the temporary interruption of nerve transmission within the subarachnoid space by injections of local anaethetics. The blockade of nerve fibres occur in the order of temperature, pain, proprioceptive and then motor fibres.

FACTORS INFLUENCING HEIGHT OF BLOCKADE:

a - Site of injection

b - Angulation of needle

c - Characteristic of local anaesthetic - baricity

d - Dose of local anaesthetic

e - Position of the patient during and after injection

f - Anatomic configuration of spinal column.

g - Patient height (at extremes)

h - Volume of cerebrospinal fluid

i - Reduced cerebrospinal fluid with increased intra abdominal pressure (eg. Pregnancy)

a) Effects on Cardio Vascular System:

Most important physiological response to subarachnoid block involve cardio vascular system due to combined effect of autonomic denervation, higher level of neural block, added effect of vagal innervation.

Local anaesthetics and vasoactive substances administered in small doses intrathecally leads to direct cardiovascular effect. Level of sympathetic denervation determines the magnitude of cardio vascular system responses, but the relationship is neither predictable nor precise.

Sympathetic denervation produces arterial and more physiologically important arteriolar dilatation and vasodilatation in the venous circulation produces fall in blood pressure.

Due to Bainbridge reflex, the fall in blood pressure is associated with bradycardia, blockade of cardiac sympathetic fibre from T1-T4 is an additional factor that causes bradycardia.

b) Effects on Respiratory System:

Respiration is not depressed normally. Higher level blockade can cause paralysis of intercostals muscles but resting tidal volume, maximum inspiratory volume, respiratory rate, arterial blood gas, negative intrapleural pressure and also the phrenic nerve are unaffected. Hypoxia may accompany hypotension and is corrected by oxygen administration via face mask.

c) Gastro Intestinal Effect:

Preganglionic fibres from T_5-L_1 are inhibitory to gut. So in sympathetic blockade the small intestine contracts with relaxed sphincters and peristalsis remains normal. Handling of viscera causes discomfort and bradycardia since vagus is not blocked.

d) Hepatic and Renal Effects:

The hepatic blood flow decreases and is directly proportional to the decrease in blood pressure. There may be normal hepatic oxygen extraction. Renal blood flow is maintained by autoregulation and does not decrease till mean arterial pressure goes below 50mmHg.

e) Genito Urinary System:

Sphincters of bladder are not relaxed, and tone of the ureter is not greatly altered. Urinary retention occurs. Penis is often engorged. Uterine tone is unchanged in pregnancy. In the absence of hypotension spinal anaesthesia has got no effect on the progress of labour and uterine blood flow.

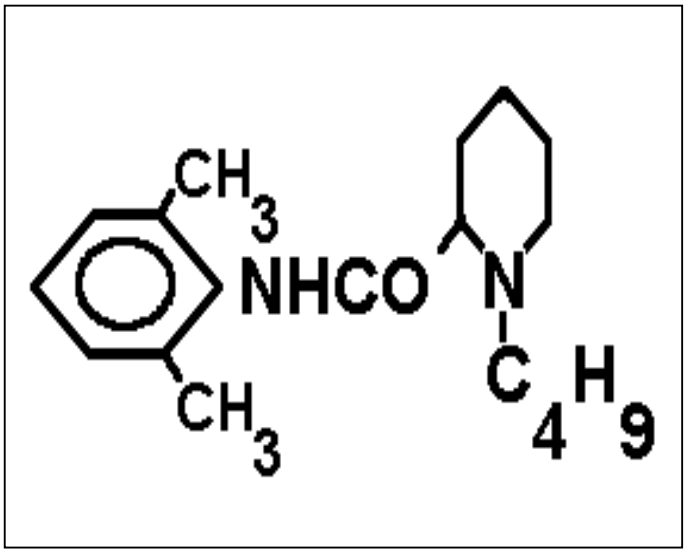
f) Metabolic and hormonal effect:

Spinal anaesthesia blocks hormonal and metabolic responses to nociceptive stimuli arising from the operative site. It minimizes the rise in blood sugar, cortisol, catecholamines, renin and aldosterone release associated with stress. Post operative negative nitrogen balance and secretion of antidiuretic hormone are inhibited.

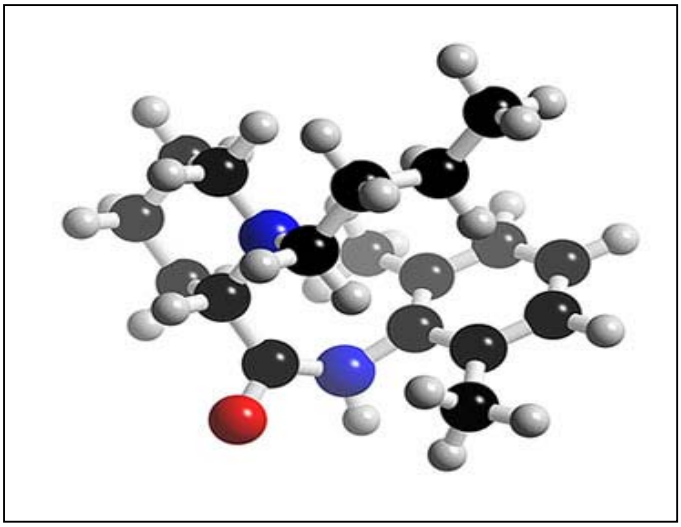
g) Thermo Regulation:

Hypothermia results from heat loss to the cold environment due to vasodilatation.

STRUCTURE OF BUPIVACAINE



THREE DIMENSIONAL VIEW OF BUPIVACAINE - MOLECULE



PHARMACOLOGY OF DRUGS

a) Bupivacaine:

Bupivacaine is an amide linked local anaesthetic. It is a hydrochloride salt of d(1)-1-butyl N-(2'6' dimethylphenyl) piperidine – 2 - carboxamide and is presented as a racemic mixture.

- It was synthesized by Ekenstem.
- First reports of its use was published in 1963 by Telivuo.
- It is derived from Mepivacaine and is very stable compound and may be autoclaved repeatedly.

Pka - 8.1

MW - 288

Protein binding - 95%

Lipid solubility - 28

Elimination half life - 210 minutes

Toxic plasma concentration - >1.5µg/ml

Approximate duration of action- 175minutes

Availability:

Available in ampoules of 0.5% Bupivacaine hydrochloride and 0.5% Bupivacaine hydrochloride with dextrose (heavy).

Vials- 0.25% and 0.5% Bupivacaine hydrochloride.

Dosage - Maximum dosage 3mg/kg body weight.

Uses:

- Spinal anaesthesia

- Epidural anaesthesia
- Caudal anaesthesia
- Continuous epidural anaesthesia
- Peripheral nerve block

Onset time and duration of action

Site of action	Onset (minutes)	Duration (minutes)
Intrathecal	5	180-240
Epidural	15-20	165-225
Brachial plexus	15-20	600

Pharmacokinetics:

Once injected intrathecally, it gets absorbed by the nerve rootlets and results in the desired effect. It is rapidly absorbed from the site of injection, but the rate of absorption depends on the vascularity at the site and presence of vasoconstrictors.

High lipid solubility of Bupivacaine makes it easy for nerve and vascular tissue penetration.

80-95% of the absorbed Bupivacaine binds to the plasma.

Distribution:

Rapid distribution phase: (α)

In this phase the drug is distributed to highly vascular region $t1/_2$ of α - being 2.7 minutes.

Slow disappearance phase: (β)

In this phase the drug distributes to slowly equilibrating tissues $t1/_2$ of β – being 28minutes.

Biotransformation and excretion phase δ

$T1/_2$ of δ is 3.5hours and clearance is 0.47 litre/minute.

Biotransformation:

Possible pathways of metabolism of Bupivacaine include aromatic hydroxylation and conjugation. Only the N-dealkylated metabolite, N-desbutyl Bupivacaine has been measured in blood (or) urine after epidural (or) spinal anaesthesia. Alpha-1 acid glycoprotein is the most important plasma protein binding site of Bupivacaine and its concentration is increased by many clinical situations including post operative trauma.

Excretion:

4-10% of the drug is excreted through the kidneys.

Mode of Action:
a) Site of action:

i) The spinal nerve rootlet fine nerve filaments having a large surface area are exposed to the local anaesthetics.

ii) Posterior and lateral aspects of the spinal cord itself.

b) Sodium Channel blockade:

They impede sodium ion access to the axon interior by occluding the transmembrane sodium channels thus delaying the process of depolarisation and axon remains polarized. It is a non-depolarisation blockade.

Pharmacodynamics:

It has got a longer duration of action but a slower onset.

Cardio vascular system:

It reduces cardiac output by reducing the sympathetic tone, by slowing the heart rate and by reducing the venous return, it produces a fall in arterial blood pressure but it is relatively slow and is seldom very profound.

It produces a fall in central venous pressure. It causes an increase in lower limb blood flow and reduction in incidence of deep vein thrombosis.

Respiratory System:

Spinal blockade seldom, if ever causes respiratory problem.

Gastro intestinal tract:

There is an increase in gastro intestinal motility and emptying of the gastric contents are better.

Toxicity:

Toxicity is related to plasma level of unbound drug and more likely due to an inadvertent intravenous injection. Systemic toxicity reactions primarily involve central nervous system and cardio vascular system. The blood level required to produce central nervous system toxicity is less than that required to produce circulatory collapse.

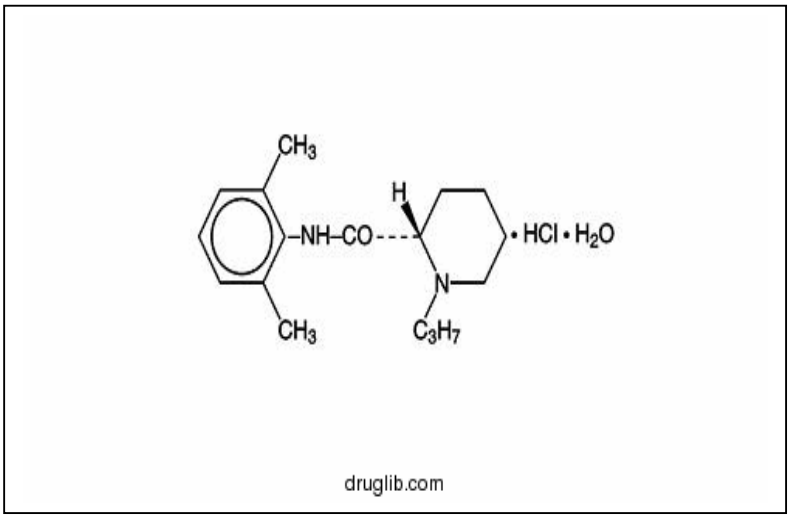
Central Nervous System Toxicity:

Initial symptoms include feeling of light headedness and dizziness, followed by visual and auditory disturbances. Objective signs are excitatory and includes shivering, muscle twitching and tremor. Ultimately generalized tonic, clonic seizures occurs.

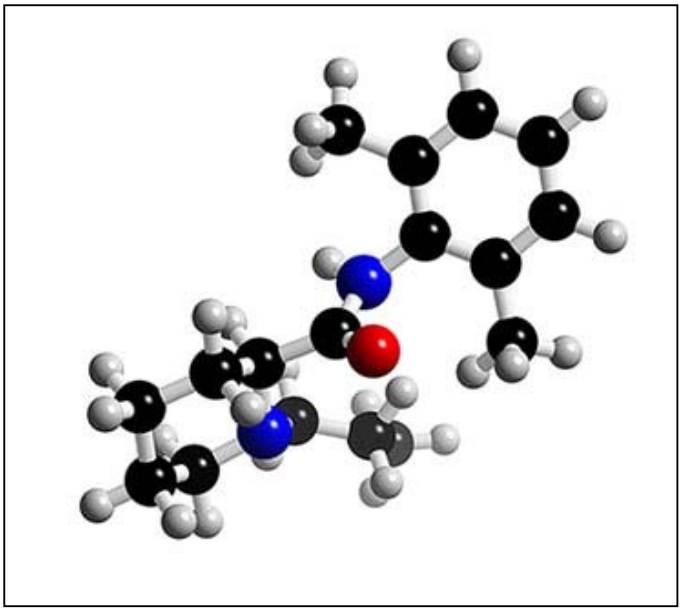
Cardiovascular System Toxicity:

The rate of depolarization in fast conducting tissue of purkinje fibres and ventricular muscle is decreased. The rate of recovery of Bupivacaine induced block is slower than that of lignocaine. Extremely high concentration of the drug causes sinus bradycardia and cardiac arrest.

STRUCTURE OF ROPIVACAINE



THREE DIMENSIONAL VIEW OF ROPIVACAINE – MOLECULE



ROPIVACAINE

Ropivacaine is a pure S-enantiomer of propivacaine, a long acting amide local anaesthetic. It is a hydrochloride salt of (S) – N – C2, 6 – dimethylphenyl – 1-propylpiperidine 2- carboxamide.

It was simultaneously synthesized with Bupivacaine by Ekenstem

It was first launched in 1996.

pKa - 8.1

MW - 328.89

Protein binding - 94%

Solubility - 53.8mg/ml in water.

Toxic plasma concentration >4 micro gram/ml.

Clearance - 44L/min.

Availability :

Available in ampoules as isobaric solution in concentrations of 0.2%, 0.5% and 0.75%

Dosage : Maximum dosage 3 mg / kg body weight

Uses :

- Spinal anesthesia
- Epidural anaesthesia

- Caudal anaesthesia
- Continuous epidural anaesthesia
- Peripheral nerve blocks

	Conc.%	Volume (ml)	Onset of action (minutes)
Spinal	0.5% 0.75%	3 – 4 3 – 4	4 – 5
Epidural	0.2% 0.5% 0.75%	15 – 20 ml	15 – 20
Caudal	0.2 %	1ml / kg	10 - 15
Peripheral block	0.5% 0.15%	15-30	15

Pharmacokinetics :

Once injected intrathecally it gets absorbed by the nerve rootlets and results in desired effect.

It is low lipid soluble when compared to Bupivacaine; it is 94% protein bound, mostly to alpha-1 acid glycoprotein.

The effect of Ropivacaine on peripheral vascularity is biphasic; it causes vasoconstriction at concentration < 0.50%, vasodilatation in concentration>1%.

Distribution :

It does not need adrenaline to prolong the duration of action.

The mean t ½ of initial phase is 14 min.

Then t ½ of slower phase is 4.2 hrs.

Clearance from epidural infusion 0.75% 5L / hr.

0.5% 10L /hr.

Biotransformation :

Ropivacaine is metabolized in liver by aromatic hydroxylation to 3- hydroxy Ropivacaine by cytochrome (CYP) 1 A2 and N- deakylation to

2', 6' pipecoloxylidide by CYP 3A4. Other metabolites include

L'-Hydroxy Ropivacaine and 2'-Hydroxy methyl Ropivacaine.

Excretion :

80% of the drug is excreted through kidneys.

Mode of action :

a) Site of action is on the spinal nerve rootlet fine nerve filaments and posterior and lateral aspects of the spinal cord itself.

b) Mechanism of action

Blocks impulse conduction in nerve fibres via reversible inhibition of sodium ion influx.

Pharmadynamics :

It has slower onset and short duration when compared with Bupivacaine. It blocks sensory fibres more than motor fibres. High Pka and low lipid solubility favours the blockade of unmyelinated C and A delta fibres which blocks the pain and temperature sensations predominantly.

Cardiovascular system :

It reduces cardiac output by reducing the sympathetic tone, by slowing the heart rate and by reducing the venous return. It also produces fall in arterial blood pressure but is relatively slow and less profound, when compared to Bupivacaine.

Respiratory system :

Spinal blockade with Ropivacaine seldom causes respiratory problem.

Toxicity :

Toxicity is related to plasma levels of unbound drug and is due to inadvertant intravenous injection or due to increased drug dosage (>3mg/kg). Ropivacaine causes more central nervous system toxicity than cardiovascular toxicity. Since Ropivacaine is a pure S-enantiomer it has less affinity for the cardiac sodium channels, hence less of cardiotoxicity.It has less volume of distribution when compared to Bupivacaine.All these features reduce the potency, but reduces the cardiotoxicity and central nervous system toxicity.

Cardiovascular toxicity:

Extreme high concentrations cause bradycardia and cardiac arrest.

Central nervous system toxicity :

Initial symptoms include feeling of light headedness and dizziness, followed by visual and auditory disturbances. Signs are excitatory including shivering, muscle twitching and tremor, finally leading to generalized tonic, clonic seizures.

Drug interactions :

The CYP1A2 inhibitors fluroxamine and ciprofloxacin significantly reduce the plasma clearance of Ropivacaine by 77% and 31% respectively.

REVIEW OF LITERATURE

1. Internet Journal of Anesthesiology, 2008, vol 17, No.1 ISSN : 1092 – 406.

A Mehta, V. Gupta and colleagues used 15 mg of isobaric Ropivacaine, Bupivacaine and Levobupivacaine intrathecally to 75 patients of 3 groups, n=25 in patients undergoing lower limb surgeries. Onset time,duration of the sensory and motor blocks and hemodynamics were noted. The onset of block was significantly shorter for Bupivacaine and Levobupivacaine as compared to Ropivacaine. The duration of sensory and motor block was shorter for Ropivacaine. Ropivacaine was better hemodynamically stable than Bupivacaine and Levobupivacaine. It concluded that Ropivacaine produce adequate spinal blockade of short duration with early ambulation and faster home discharge when compared with Bupivacaine and Levobupivacaine.

2. Acta Anesthesiologica Belgica 2008, 59, 65-71.

Comparison of plain Ropivacaine, Bupivacaine and Levobupivacaine for lower abdominal surgeries.

Mantouvalou, S. Kalli and collegues compared the safety and efficacy of 15mg of plain Ropivacaine, Bupivacaine and Levobupivacaine in 120 patients undergoing lower abdominal surgeries. Ropivacaine presented a slower onset and a shorter duration of motor and sensory block compared with Bupivacaine and Levobupivacaine. There was higher incidence of hypotension in Bupivacaine group compared to others.

3. Anaesthesiology 1999 ; 91 : 1239- 45

Gautier PE, DE Kock, Van steenberge A et al, Department of Anesthesiology, Brussels, Belgium.

The study was conducted with intrathecal isobaric Ropivacaine and Bupivacaine for ambulatory surgeries. 4 ml of isobaric 8mg Bupivacaine and 4 ml of 8 mg isobaric Ropivacaine, 10 mg Ropivacaine, 12 mg Ropivacaine and 14 mg of Ropivacaine were used and the level, duration of sensory and motor block and intensity of motor block recorded. Intrathecal 12 mg is approximately equivalent to Bupivacaine 8 mg.

4. Journal of Clinical Anaesthesia (2006) 18, 521 – 525.

Neval Boztuz MD, and collegues from Department of Anaesthesiology, Antalya. Turkey.

Comparison of Ropivacaine and Bupivacaine for intrathecal anaesthesia during outpatient arthroscopic surgery.

15 mg of isobaric Ropivacaine and 7.5 mg of isobaric Bupivacaine were used intrathecally. Onset and offset of sensory and motor block was delayed in Ropivacaine. Highest level obtained was lower for Ropivacaine.

5. British Journal of Anaesthesiology 2002 ; 89 : 702 – 6.

Mc Clelland, A.M, McNamee D and collegues used 3.5 ml of isobaric Ropivacaine and Bupivacaine.

A double blinded comparison of intrathecal Ropivacaine 5 mg / ml and Bupivacaine 5 mg / ml for total hip arthroplasty.

Onset of motor and sensory block was rapid and equal. The median duration of motor block was 3.7 hrs in Ropivacaine group and 5 hrs in Bupivacaine group. The median duration at T10 was 3 hrs in Ropivacaine group and 3-5 hrs in Bupivacaine group. Adverse events were similar between both groups. Quality of block was equal in

both groups. Ropivacaine is an alternative to Bupivacaine with the benefit of a shortened period of motor block..

6. Anaethesia and Analgesia 2000, 91 : 1457 – 60.

Intrathecal anesthesia : Ropivacaine versus Bupivacaine, Jean, Marc Malinovsky MD, Florence Charles, Ottman Kick and collegues compared 15 mg of isobaric Ropivacaine and 10 mg Bupivacaine for TURB or TURP. Cephalad spread of sensory block was T7 for Bupivacaine and T9 for Ropivacaine. They concluded that 15 mg Ropivacaine provided similar motor and hemodynamic effects but less potent analgesia than 10 mg of Bupivacaine for endoscopic urological surgery.

7. British Journal of Anaesthesia 2001 June, vol 87, No.5, 743-747.

Intrathecal Ropivacaine for total hip arthroplasty : double blind comparative study with isobaric 7.5 mg / ml and 10 mg / ml solution. McNanee. L. Parts, A.M. Clelland studied median time of onset sensory block at T10 dermatome was 2 min in both groups. The median duration of sensory block at T10 was 3 hrs in 7.5 mg / ml group and 3-4 hrs in 10 mg / ml group. Complete motor block was significantly prolonged in 10 mg / ml group.

8. Indian Journal of Anaesthesia 2006 – 46 (6) 445 – 448.

Comparison of hypobaric, isobaric and hyperbaric Bupivacaine for spinal anaesthesia in patients undergoing knee arthroplasty.

Dr. Rama Nason, Dr. Anup Gogia, Dr. Ameeta Sahni, Dr. Rupa, concluded that the upper level of sensory block was 2 segments high in hyperbaric and hypobaric than isobaric solutions.

MATERIALS AND METHODS

This study was done in 100 patients who are divided into two groups, after getting approval from the Ethical Committee. Written informed consent was taken from all patients. It is a prospective randomized double blinded study.

100 patients were randomly allocated into two groups 50 each

Group B - received isobaric Bupivacaine 0.5% 3 ml(15 mg)

Group R - received isobaric Ropivacaine 0.5% 3 ml(15 mg)

Inclusion Criteria :

ASA I & II patients

Age 20 – 60 years, Height : 150 – 170 cms

Patients undergoing elective lower limb and perineal surgeries with duration less than 2 hrs.

Exclusion criteria are

- Patient refusal
- ASA III & IV
- Morbidly Obese patients
- Patients with neurological disease

- Spinal deformity
- Drug allergy to local anaesthetics
- Any other contraindication for regional technique

Preoperative preparation :

Routine pre operative assessment as for all elective surgery .

Premedicated with Inj. Pentazocine 0.6mg/kg and Glycopyrollate 0.005mg/kg given intramuscularly 45 minutes before surgery.

Name, IP No., Age, Sex, Weight, Height, ASA, Diagnosis, type of surgery and duration of surgery were recorded.

Procedure Details :

Monitors are connected to the patient and the baseline values of pulse rate, systolic and diastolic blood pressure and oxygen saturation were noted. IV cannula inserted ; Ringer lactate infusion started.

Under strict aseptic precautions, after infiltration of skin with 1% lignocaine, subarachnoid block was performed in the sitting position in L3-L4 interspace with a 25 gauge Quincke's needle.

After ensuing free flow of CSF, the drug was injected. After injection, patients were put up in supine position. After attaining adequate level of sensory block, the surgeons were asked to proceed with the surgery.

Parameters recorded :

1. Hemodynamic parameters :

a) **Pulse rate, non invasive blood pressure and oxygen saturation** were monitored every 2 minutes for the first 10 minutes and every 5 minutes till 1hour and every 15 minutes till the end of surgery.

b) Any decrease in mean arterial pressure 20% from the baseline or less than 90mm of systolic pressure was treated with a bolus of ephedrine (6 mg).

c) Any decrease in pulse rate less than 60/min was treated with atropine 0.6 mg.

2. Sensory blockade:

Sensory blockade was assessed by pin prick in the mid axillary line at 1 min interval until the level of block reached L1. The maximum height of the sensory blockade was noted.

Onset of sensory block was defined as the time taken from injection of drug to sensory block at L1 and offset of sensory block was assumed when pinprick sensation at the S 5 dermatome has returned. Duration of sensory block was defined as the time interval between onset of sensory block at L1 to regression of sensory block to S5.

3 . Motor blockade :

Motor block was assessed by the Modified Bromage score.

0 - No motor loss

1 - Inability to flex hip

2 - Inability to flex knee joint

3 - Inability to flex ankle

This is assessed at 1 min interval until complete motor blockade occured. Onset of motor block was defined as the time taken from injection of drug to development of

complete motor block. (Bromage Score-3). Bromage score '0' was considered as complete recovery from motor block. Duration of motor block was defined as time taken from onset of complete motor block to complete recovery of motor block.

4. The highest dermatomal level of sensory block was noted**.**

5. Time taken to achieve the highest dermatomal level was noted**.**

6. Two segment regression time (ie. The time taken to decrease from maximum sensory level by two segments from initial level) was noted.

7. Quality of block was graded as adequate – no sedation / analgesia required, Inadequate – need for additional analgesia, failed – GA required. If the level of analgesia was inadequate or failed the regimen was switched to GA and excluded from the study.

8. Time of micturation was noted.

9. Duration of surgery were noted.

Statistical Tools :

The information collected regarding all the selected cases were recorded in Master Charts 1 and 2 .Data analysis was done with the help of computer using **Epidemiological Information Package (EPI 2008).**

Using this software range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. Kruskul Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

OBSERVATION AND RESULTS

In this randomized double blinded study conducted in 100 patients, the subjects were allocated into 2 groups,

Group B ;Isobaric Inj.Bupivacaine 0.5% - 3 ml(15 mg)

Group R ;Isobaric Inj. Ropivacaine 0.5% -3ml(15 mg)

All the parameters recorded are tabulated and analysed.

Table 1 : Age distribution

Age group(yrs)	Group B		Group R	
	No.	%	No.	%
20- 30	9	18	14	28
31-40	17	34	11	22
41-50	13	26	15	30
>50	11	22	10	20
Total	50	100	50	100
Range	20-60 yrs		20-60 yrs	
Mean	40.84		39.76	
SD	10.42		12.41	
'p' value	0.638 Not significant			

The mean age are comparable and they are not statistically significant.

AGE DISTRIBUTION

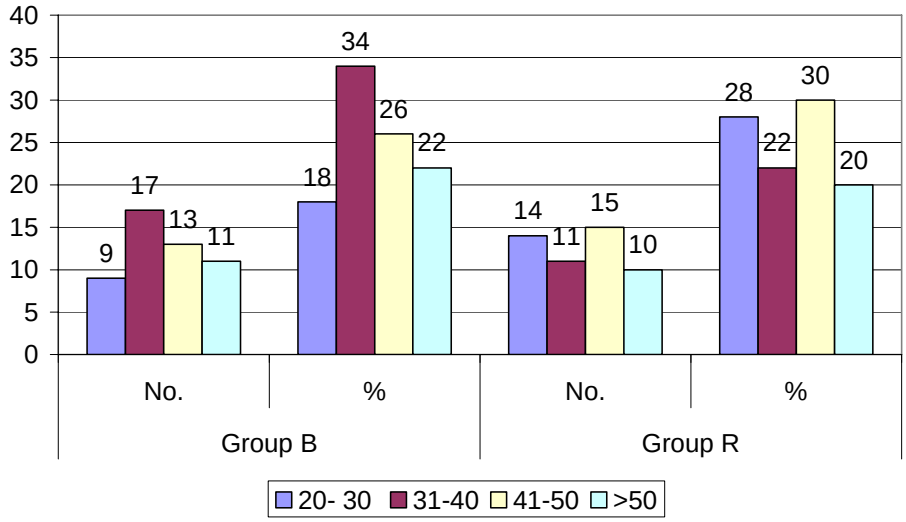


Table 2: Sex distribution

Sex distribution	Group B		Group R	
	No.	%	No.	%
Male	41	82	40	80
Female	9	18	10	20
Total	50	100	50	100
'p' value	0.542 Not significant			

The sex distribution are comparable and they are not statistically significant.

SEX DISTRIBUTION

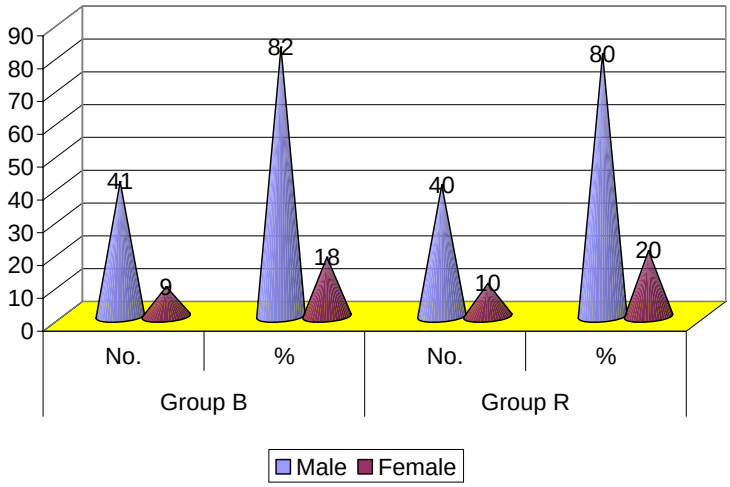


Table 3 : Height(cms)

Height (cm)	Group B		Group R	
	No.of cases	%	No.of cases	%
150 – 160	30	60	23	46
161 – 170	20	40	27	54
Range	150-170		150-170	
Mean	159.8		161.72	
SD	6.21		5.22	
'p' value for	0.097 Not significant			

The mean height in both the groups are comparable and they are not statistically significant.

HEIGHT IN CMS

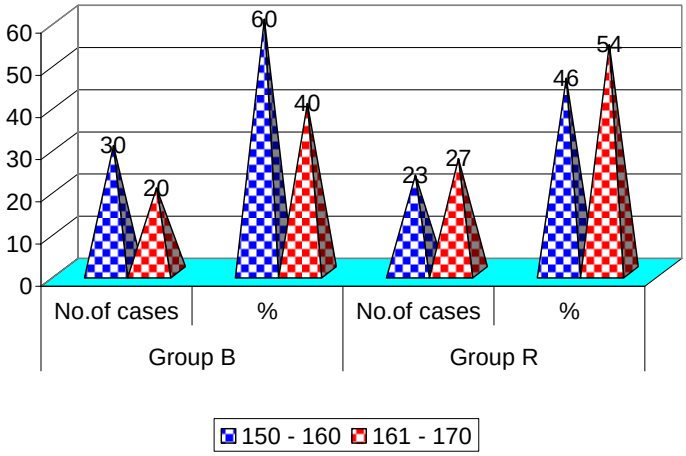


Table 4 : Weight(kg)

Weight(kg)	Group B	Group R
Range	45-75	50.70
Mean	59.04	60.48
SD	5.86	5.36
'p' value	0.203 not significant	

In both groups the weights are comparable they are not statistically significant

WEIGHT (KGS)

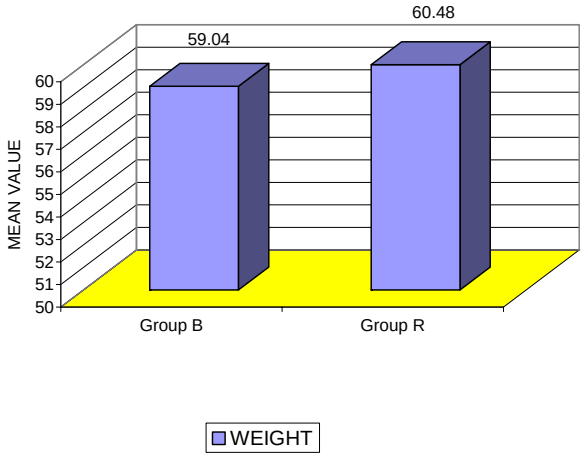

60.48
59.04
MEAN VALUE
60
59
58
57
56
55
54
53
52
51
50
Group B
Group R
WEIGHT

TABLE - 5 : ASA Physical status

ASA risk	Group B		Group R	
	No.	%	No.	%
I	46	92	46	92
II	4	8	4	8
'p' value	1.000 Not significant			

The ASA physical status are comparable and they are not statistically significant.

ASA RISK

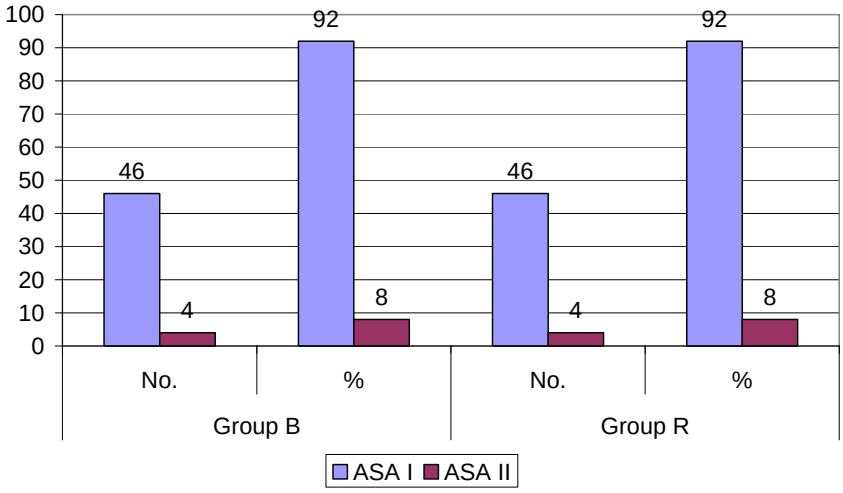

100
90
80
70
60
50
40
30
20
10
0
46
4
92
8
46
4
92
8
No.
%
No.
%
Group B
Group R
ASA I
ASA II

Table - 6 : Onset of Sensory Block (minutes)

Onset of Sensory Block(min)	Group B	Group R
Range	2 – 5	4 – 8
Mean	3.32	6.40
SD	0.741	0.948
'p' value	< 0.001 significant	

In Group B the mean onset of sensory block is 3.32minutes.

In Group R the mean onset of sensory block is 6.40minutes.

The mean onset of sensory block is delayed in Ropivacaine when compared to Bupivacaine and is statistically significant.

ONSET OF SENSORY BLOCK IN MINUTES

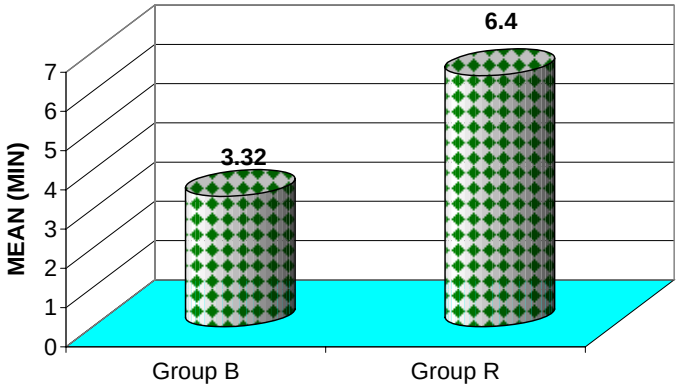


Table - 7 : Maximum Sensory Level

Maximum Sensory Level	Group B		Group R	
	No.	%	No.	%
T4	4	8	0	0
T5	8	16	0	0
T6	23	46	0	0
T7	12	24	0	0
T8	3	6	7	14
T9	0	0	6	12
T10	0	0	26	52
T12	0	0	11	22

In Group B the maximum sensory level ranges from T4-T8 and in 46% of cases the maximum level reached is T6 .

In Group R the maximum sensory level ranges from T8-T12 and in 52% of cases the maximum level reached is T10.

Ropivacaine reaches a low sensory level when compared to Bupivacaine.

MAXIMUM SENSORY LEVEL

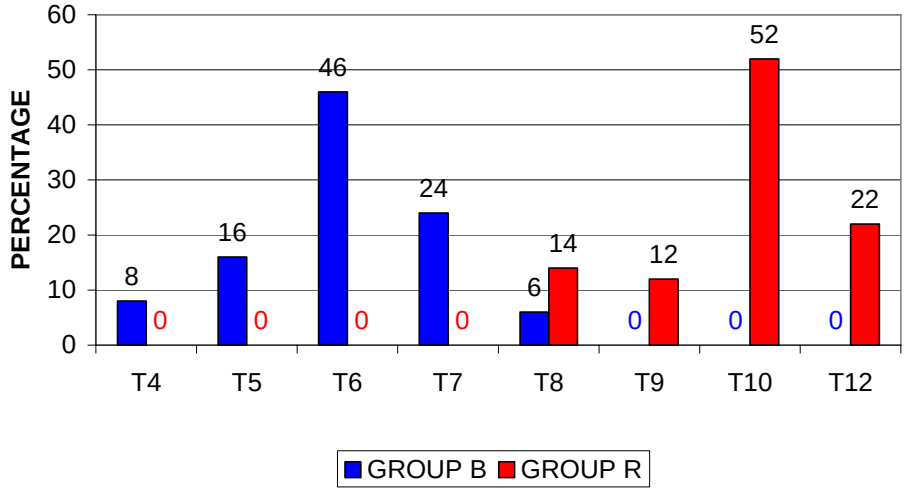


Table - 8 : Time taken to reach the Max. sensory height (min)

Time to reach maximum sensory level(min)	Group B	Group R
Range	12 – 16	12 -18
Mean	14.26	14.76
SD	0.944	1.302
'p' value	0.060 Not Significant	

In Group B the time taken to reach the highest sensory level is 14.26 minutes. In Group R the time taken to reach the highest sensory level is 14.76 minutes. Both groups are comparable and it not statistically significant.

Time taken to reach the Max. sensory height (min)

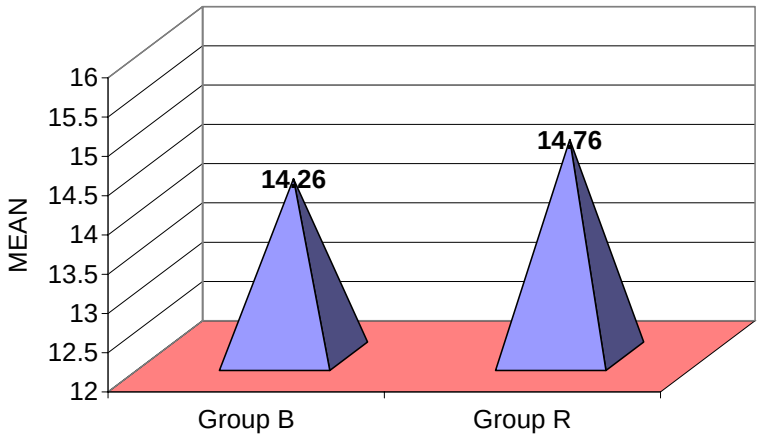


Table -9 : Two segment Regression Time (minutes)

Two segment regression time(min)	Group B	Group R
Range	75 – 155	45 – 165
Mean	97.9	63.7
SD	11.48	21.02
'p' value	< 0.001significant	

In group B, the mean value of time taken for two segment regression is 97.9 minutes. In group R, the mean value of time taken for two segment regression is 63.7 minutes. The two segment regression time is shorter for Ropivacaine than Bupivacaine and is statistically significant.

Two segment Regression Time (minutes)

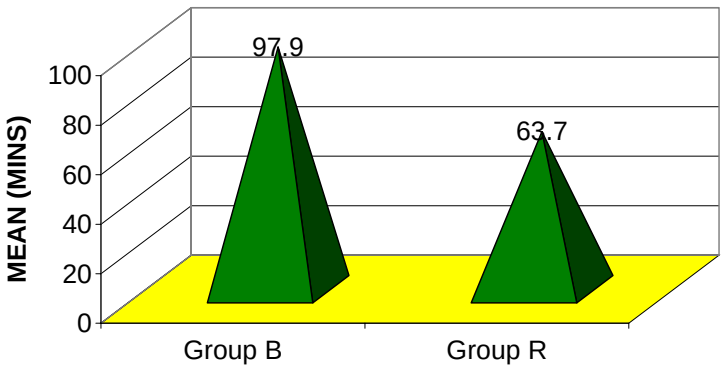


Table -10 : Onset of Motor block (min)

Onset of motor block(min)	Group B	Group R
Range	3 – 7	8 – 12
Mean	4.70	9.40
SD	0.886	1.069
'p' value	< 0.001significant	

In Group B the mean onset of motor block is 4.70 minutes.

In Group R the mean onset of motor block is 9.40 minutes .The onset of motor block of Ropivacaine is delayed when compared to Bupivacaine and is statistically significant.

ONSET OF MOTOR BLOCK (MINS)

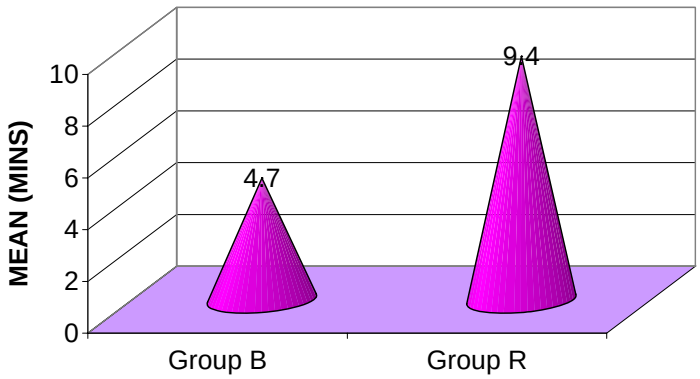


Table - 11 : Duration of Sensory Block (min)

Duration of Sensory Block	Group B	Group R
Range	180-245	120-190
Mean	219.9	162.9
SD	17.04	15.55
'p' value	< 0.001significant	

In Group B the mean duration of sensory block is 219.9 minutes.

In Group R the mean duration of sensory block is 162.9 minutes.

The duration of sensory block is shorter for Ropivacaine compared with Bupivacaine and is statistically significant.

DURATION OF SENSORY BLOCK (MINS)

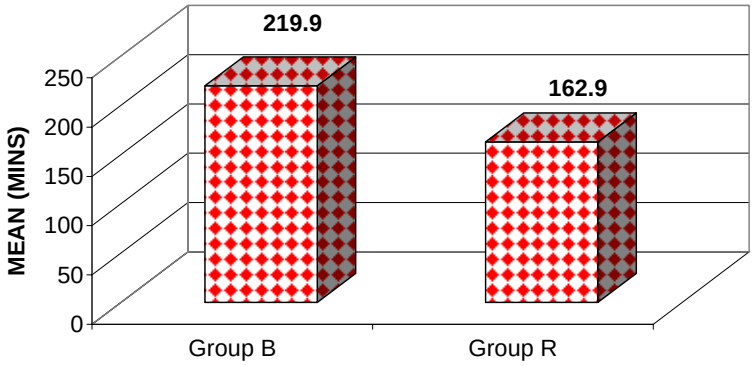


Table - 12 : Duration of Motor Block(min)

Duration of Motor Block(min)	Group B	Group R
Range	165-235	100-175
Mean	203.8	142.9
SD	17.16	14.61
'p' value	< 0.001 Significant	

In Group B the mean duration of motor block is 203.8.minutes.

In Group R the mean duration of motor block is 142.9minutes.

The duration of motor block is shorter for Ropivacaine when compared to Bupivacaine and is statistically significant.

Duration of Motor Block(min)

Table – 13 Quality of Block

Adequate	Group B		Group R	
	No.	%	No.	%
Yes	0	0	0	0
No	50	100	50	100

The quality of block was adequate in both groups

QUALITY OF BLOCK (ADEQUACY)

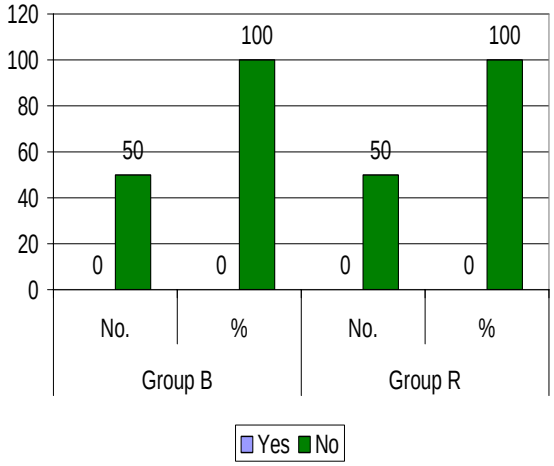


Table - 14 : Time of micturation (in Minutes)

TIME OF MICTURATION	Group B	Group R
Range	260-340	200-270
Mean	319.0	240.8
SD	16.93	14.55
'p' value	< 0.001 Significant	

In Group B the time taken to micturate is 319 minutes. In Group R the time taken to micturate is 240.8 minutes.The time taken to micturate is shorter for Ropivacaine compared with Bupivacaine and is statistically significant.

Time of micturation (in Minutes)

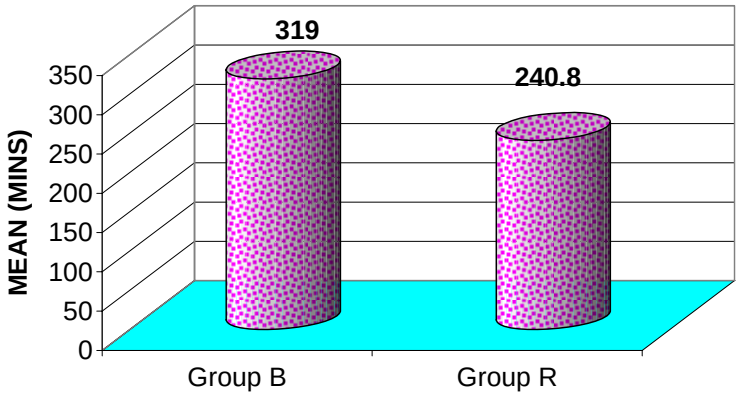


Table 15 : FALL IN PULSE RATE (%)

FALL IN PULSE RATE	Group B		Group R	
	No.	%	No.	%
Yes	14	28	3	6
No	36	72	47	94
'p' value	0.003 Significant			

In group B, 28% of cases had bradycardia and in Group R, 6% of cases had bradycardia (less than 60/min), which is significant.

PULSE RATE FALLIN PERCENTAGE

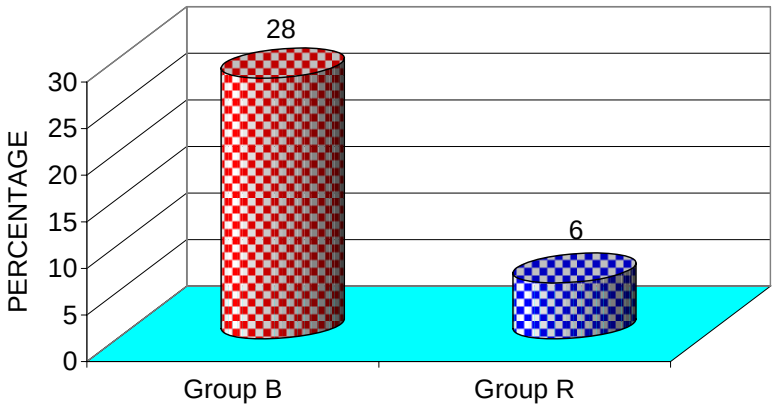


Table 16 : PULSE RATE(per min)

PULSE RATE	Group B		Group R		P value
	Mean	SD	Mean	SD	
Pre op	83.22	9.09	81.44	0.283	0.283Not significant
2 min	82.24	9.03	80.12	0.195	0.195Not significant
4 min	81.88	8.51	79.10	0.063	0.063Not significant
6 min	79.06	8.46	80.40	0.564	0.564Not significant
8 min	79.06	8.39	80.26	6.18	0.418Not significant
10 min	76.32	8.96	78.50	8.10	0,205Not significant
15 min	75.26	7.51	78.120	8.26	0.073Not significant
20 min	72.12	7.658	77.62	10.03	0.063Not significant
25 min	70.70	9.19	77.66	10.25	0.001 Significant
30 min	73.10	10.08	80.08	10.69	0.001 Significant
35 min	76.3	10.94	82.32	11.45	0.042 Significant
40 min	77.46	10.12	82.04	11.76	0.064Not significant
45 min	78.74	10.18	78.76	10.20	0.074Not significant
50 min	80.22	11.21	81.13	10.59	0.074Not significant
55 min	80.85	11.60	80.54	11.46	0.082Not significant
60 min	83.86	11.45	84.83	10.60	0.404Not significant
75 min	84.67	16.16	87.33	10.58	0.744Not significant

Fall in pulse rate occured between 25 to 35 minutes which is significant.

Table 17 : FALL IN SYSTOLIC BP

FALL IN SYSTOLIC BP	Group B		Group R	
	No.	%	No.	%
Yes	14	28	3	6
No	36	72	47	94
'p' value	0.003 Significant			

In group B, 28% of cases had fall in systolic BP and in Group R, 6% of cases had fall in systolic BP, which is significant.

SYSTOLIC BP FALL IN PERCENTAGE

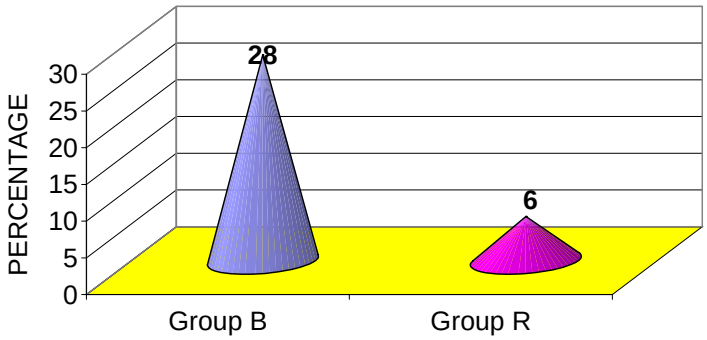


Table 18: Systolic Blood Pressure(mm of Hg)

Systolic B.P.	Group B		Group R		P value
	Mean	SD	Mean	SD	
Pre op	123.9	8.12	121.76	7.06	0.163 Not significant
2 min	121.4	17.52	121.4	6.21	1.000 Not significant
4 min	121.88	7.003	120.36	5.78	0.239 Not significant
6 min	119.56	7.93	118.68	5.95	0.532 Not significant
8 min	116.84	8.26	117.6	5.84	0.597 Not significant
10 min	113.72	7.65	115.18	7.03	0.323 Not significant
15 min	111.50	9.67	112.68	6.43	0.474 Not significant
20 min	110.10	10.005	111.84	6.77	0.311 Not significant
25 min	107.8	6.31	110.12	5.89	0.032 Significant
30 min	109.96	6.95	110.8	4.67	0.025 Significant
35 min	111.78	7.71	110.52	4.77	0.014 Significant
40 min	113.88	8.80	111.56	6.44	0.136 Not significant
45 min	116.38	13.32	112.4	6.99	0.064 Not significant
50 min	115.95	8.35	114.85	6,14	0.490 Not significant
55 min	118.26	7.87	116.56	6.016	0.320 Not significant
60 min	121.18	6.81	118.13	5.73	0.164 Not significant
75 min	124	6.93	123.3	4.27	0.829 Not significant

The fall in systolic BP occured between 25 to 35 minutes which is significant.

Table 19 : FALL IN DIASTOLIC BP

FALL IN DIASTOLIC BP	Group B		Group R	
	No.	%	No.	%
Yes	14	28	3	6
No	36	72	47	94
'p' value	0.003 Significant			

In group B, 28% of cases had fall in diastolic BP and in Group R, 6% of cases had fall in diastolic BP ,which is significant.

DIASTOLIC BP FALL IN PERCENTAGE

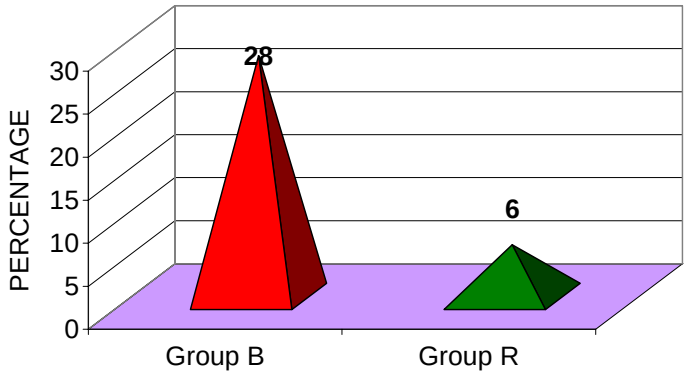


Table 20 : Diastolic Blood Pressure(mm of Hg)

Diastolic B.P.	Group B		Group R		P value
	Mean	SD	Mean	SD	
Pre op	79.28	4.48	79.08	3.92	0.813 Not significant
2 min	79.16	4.58	79.04	3.82	0.887 Not significant
4 min	78.30	4.93	78.84	3.86	0.543 Not significant
6 min	77.20	4.40	77.80	4.43	0.499 Not significant
8 min	75.96	5.15	77.56	4.39	0.098 Not significant
10 min	74.92	6.78	76.92	5.18	0.068 Not significant
15 min	73.40	7.04	75.90	5.99	0.066 Not significant
20 min	72.38	5.81	75.52	5.02	0.005 significant
25 min	71.80	6.88	74.62	5.72	0.025 significant
30 min	72.70	5.89	74.44	3.45	0.037 significant
35 min	73.60	5.24	73.68	4.03	0.932 Not significant
40 min	74.92	5.05	73.34	3.39	0.084 Not significant
45 min	74.80	5,16	73.16	4.35	0.089 Not significant
50 min	75.70	6.75	73.55	5.01	0.073 Not significant
55 min	75.66	4.54	74.56	4.26	0.296 Not significant
60 min	75.73	4.24	76.0	3.67	0.834 Not significant
75 min	79.0	3.83	78.5	2.07	0.770 Not significant

The fall in diastolic BP occured between 20 to 30 minutes which is significant.

Table No. 21 Oxygen saturation in %

Oxygen saturation in %	Group B	Group R
Range	98-100	98-100
Mean	99.26	99.26
SD	0.694	0.664
'p' value	P = 1.000 Not Significant	

The oxygen saturation is comparable in both groups. It is not statistically significant.

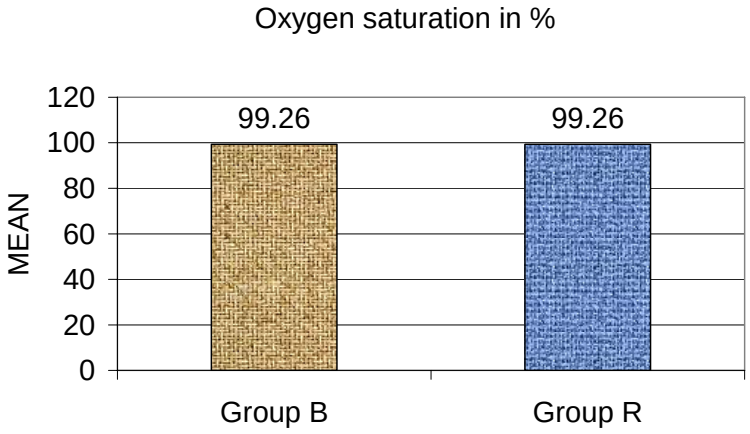

Oxygen saturation in %
120
100
80
60
40
20
0
MEAN
99.26
99.26
Group B
Group R

Table 22 : Use of Atropine

Use of Atropine	Group B		Group R	
	No.	%	No.	%
Yes	14	28	3	6
No	36	72	47	94
'p' value	0.003 Significant			

Atropine is used in 28% of cases in Group B and 6% of cases in Group R. Atropine is used less in Ropivacaine group compared to Bupivacaine group and is statistically significant.

USE OF ATROPINE

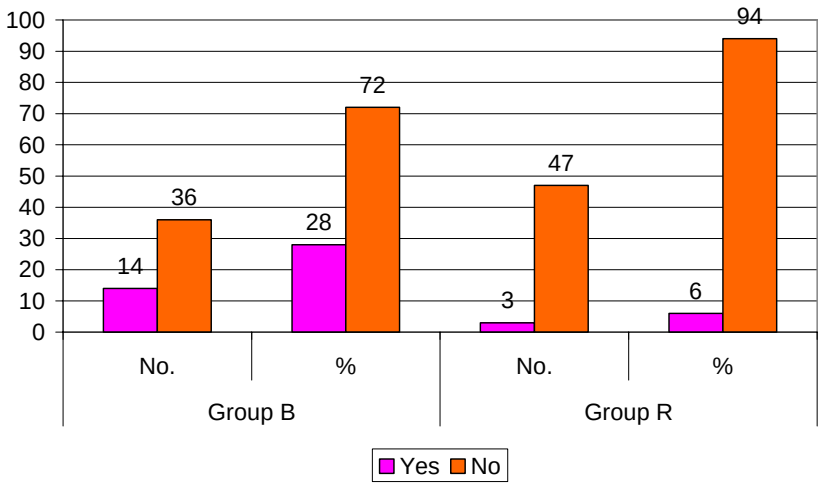
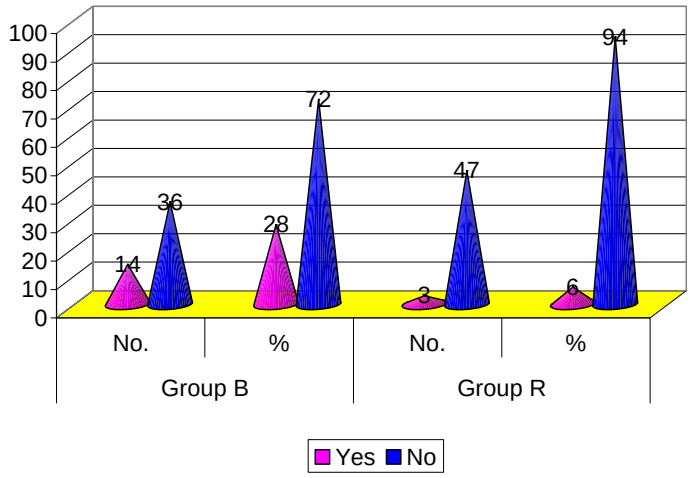


Table 23 Use of Vasopressor

Use of Vasopressor	Group B		Group R	
	No.	%	No.	%
Yes	14	28	3	6
No	36	72	47	94
'p' value	0.003 Significant			

Vasopressor is used in 28% of cases in Group B and 6% of cases in Group R. Vasopressor is used less in Ropivacaine group compared to Bupivacaine group and is statistically significant.

USE OF VASOPRESSOR



DISCUSSION

Hyperbaric Bupivacaine is commonly used intrathecally for lower limb and perineal surgeries. The newly introduced Ropivacaine have evolved a history in spinal anaesthesia because of its short duration of action and quality of anesthesia for surgeries of short duration.

Ropivacaine, because of its differential blockade, is used in epidural labour analgesia and in epidural post operative analgesia.

In isobaric drug, gravity has no effect on the distribution. The upper level of sensory block was two segments higher in hyperbaric and hypobaric than isobaric solutions. So possibly fewer segments are blocked, limiting the extent of sympathetic block and hence more of hemodynamic stability.

In this study isobaric Bupivacaine and isobaric Ropivacaine at equal doses (15 mg)are given intrathecally for lower limb surgeries and perineal surgeries of short duration.

Onset of sensory block :

In this study, onset of sensory block at L1 is 6.4 minutes for Ropivacaine group and3.32minutes for Bupivacaine group. This delay is due to the lower lipid solubility of Ropivacaine when compared to Bupivacaine. A Mehta, V. Gupta and collegues studied in 75 patients and concluded that the onset of sensory level is delayed in Ropivacaine than Bupivacaine, which is similar to this study.

Maximum sensory level (Dermatome)

In this study, the maximum sensory level ranges from T8-T2 in Ropivacaine group and T4 – T8 in Bupivacaine group. Since more segments are blocked in Bupivacaine group, the extent sympathetic block is more and there is more of

hypotension and bradycardia in Bupivacaine group compared to Ropivacaine group. Hence vasopressors and atropine are used more in Bupivacaine group than Ropivacaine group. So Ropivacaine is more of hemodynamically stable than Bupivacaine. M. Montouvalou and collegues conducted a study and concluded that maximum sensory level reached is higher for Bupivacaine than Ropivacaine, which is similar to this study.

Time taken to reach the highest dermatome :

In this study, Ropivacaine took 14.76 minutes, when compared to 14.26 minutes for Bupivacaine. There is no marked difference in both. In studies of Malinovsky, Charles and collegues, they concluded that the time taken to reach the highest dermatome is same in both Ropivacaine and Bupivacaine ,which is similar to this study .

Two segment regression time :

In this study, two segment regression time in Ropivacaine group was 63.7 minutes and Bupivacaine group was 97.9 minutes. The two segment regression time is shorter for Ropivacaine when compared to Bupivacaine.

Onset of motor block :

In this study, onset of motor block is 9.40 minutes in Ropivacaine group and 4.70 minutes in Bupivacaine group. The onset of motor block is delayed in Ropivacaine when compared to Bupivacaine. A.Mehta V.Gupta and collegues conducted a study and concluded that onset of motor block is delayed in Ropivacaine when compared to Bupivacaine, which is similar to this study.

Duration of sensory block :

In this study, the duration of sensory block is 162 .9 minutes in Ropivacaine and 219 minutes for Bupivacaine group. The duration of sensory block is shorter in Ropivacaine than Bupivacaine. Hence Ropivacaine is an ideal drug for ambulatory

surgeries. A.Mehta V.Gupta and collegues and the study by Gautier et al concluded that duration of sensory block is shorter for Ropivacaine than Bupivacaine, which is comparable with this study.

Duration of motor block :

In this study, the duration of motor block is 142.9 minutes in Ropivacaine group when compared to 203.8 minitues in Bupivacaine group. The duration of motor block is shorter for Ropivacaine than Bupivacaine, making it an ideal drug for ambulatory surgeries. Neval Boztug and Zekiye Biget and collegues conducted a study and concluded that the duration for motor block is shorter for Ropivacaine than Bupivacaine making it an ideal drug for ambulatory surgeries.

Time of Micturation :

In this study time taken to urinate for the first time after block was 240.8 minutes in Ropivacaine group and 319 minutes for Bupivacaine group, making it an ideal drug for ambulatory surgery, since patients can be discharged earlier. Neval Boztug and Zekiye Biget and collegues conducted a study and concluded that the time taken for micturation is shorter for Ropivacaine than Bupivacaine, making it an ideal drug for ambulatory surgeries.

Quality of Block :

In this study, quality of block was adequate in both groups. Hence Ropivacaine is a good alternative to Bupivacaine for lower limb and perineal surgeries.

Stuides conducted by McChelland, Mc Namee and collegues showed that quality of block was adequate both with Ropivacaine and Bupivacaine groups, which is similar with this study.

Hemodynamics :

1. Pulse rate :

In this study bradycardia occurred in 28% of cases in Bupivacaine group and 6% of cases in Ropivacaine group and treated with atropine 0.6 mg. Bradycardia occured between 25-35 minutes. Hence Ropivacaine is hemodynamically stable than Bupivacaine. Use of Atropine was less in Ropivacaine group than Bupivacaine group.

2. Blood pressure :

In this study fall in B.P occurred in 28% of cases in Bupivacaine group and 6% of cases in Ropivacaine group and treated with ephedrine 6.0 mg.Fall in B.P occurred between 25-35 minutes.Use of Ephedrine was less with Ropivacaine group than Bupivacaine group. Hence Ropivacaine is hemodynamically stable than Bupivacaine. Montouvalou ,

Kalli and collegues conducted a study and has noted high incidence of hypotension in Bupivacaine group than Ropivacaine group, which is similar to this study.

3. Oxygen saturation :

In this study, oxygen saturation maintained the same as preoperative level, through out the surgery in both Bupivacaine and Ropivacaine groups.

SUMMARY

This randomized double blind study was conducted in 100 patients, aged 20-60 years with height 150-170 cms with ASA I and II. In groupB, 3 ml of isobaric 0.5% Bupivacaine is given intrathecally and in Group R 3 ml of isobaric 0.5% Ropivacaine. Parameters such as onset of sensory block L1, maximum dermatome of sensory block, time to reach the maximum height of sensory block, two segment regression time, duration of sensory block, onset and offset of motor block, time of micturation and quality of block were observed. Pulse rate, blood pressure and oxygen saturation were monitored. The usage of vasopressors and atropine were noted.

Ropivacaine significantly delayed the onset of motor and sensory block. But two segment regression, offset of sensory and offset of motor block, time of micturation were earlier than Bupivacaine. The quality of block was adequate in both groups.

In group R, the hemodynamics were stable compared with GroupB and use of vasopressors and atropine were less with Ropivacaine than Bupivacaine. There were no changes in oxygen saturation in both groups.

CONCLUSION

Intrathecal Ropivacaine delayed the onset of sensory and motor block; lowered the level of sensory block; shortened the duration of motor and sensory block, two segment regression time and time of micturation; with stable hemodynamics, than Bupivacaine.

Ropivacaine is an ideal drug for ambulatory anesthesia and a good alternative to Bupivacaine for surgeries of short duration.

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PROFORMA

Name : Date :

Age : Sex :

IP No. : Ht : Wt :

ASA :

Diagnosis : Surgery :

Drug :

Premedication:

Spinal Needle guage : Interspace :

Posture :

Onset of sensory block (Time of injection to sensory block at L1)	Max. height of sensory block	Time to reach max.height	Onset of motor block (Time of injection to complete motor block)	Time of 2 segment regression	Offset of sensory level at S5	Duration of motor block (onset of complete block to offset of motor block– Bromage 0)	Time of mictu ration

Hemodynamics

Time	Heart Rate	NIBP	SPO2	Vasopressor (Ephedrine in mg)	Atropine in mg
Pre op					
2 min					
4 min					
6 min					
8 min					
10 min					
15 min					
20 min					
25 min					

30 min					
35 min					
40 min					
45 min					
50 min					
55 min					
60 min					
75 min					
90 min					

Duration of Surgery :

Duration of sensory block :

Duration of Motor block :

Quality of Block :

Time of micturation :

If Ephedrine used, Dose :

If Atropine used, Dose :

Other complications :

MASTER CHART - 1

S.No.	Name	IP No.	Surgery	Group	Age	Sex	Height	Weight	ASA	VASO PRESSOR	ATROPINE	ONSET OFSENSORY BLOCK AT L1	MAX HT OF SENSORY BLOCK	TIME TO ACHIEVE MAX.HT	ONSET OF MOTOR BLOCK	2 SR	DURATION OF SENSORY BLIOK	DURATION OF MOTOR BLOCK	QUALITY OF BLOCK	TIME OF MICTURITION	DURATION OF SURGERY
1	MUNEESWARAN	26347	LL wound debrima with AB beading	B	39	M	160	60	1	NO	NO	3	T6	14	5	105	190	175	ADQ	320	75
2	ARUMUGAM	29911	Hemaroidectomy	B	35	M	162	55	1	NO	NO	4	T6	14	6	100	220	210	ADQ	330	60
3	SHARIF	29936	Hemaroidectomy	B	41	M	155	60	1	NO	NO	3	T7	15	5	90	230	215	ADQ	320	55
4	VELMURUGAN	26945	LL Raw area SSG	B	34	M	160	52	1	NO	NO	4	T6	13	6	95	185	170	ADQ	300	50
5	SELIN	23332	LL Raw area SSG	B	54	F	150	50	1	NO	NO	2	T8	14	4	95	195	175	ADQ	310	50
6	KANNAN	11458	Frac BB Rt Flap cover	B	32	M	165	60	1	NO	NO	3	T5	14	5	100	245	230	ADQ	320	55
7	VELU	35129	EX fixation	B	56	M	160	55	2	NO	NO	3	T6	15	4	105	220	205	ADQ	340	55
8	LAXMANAN	36546	IM nailing	B	27	M	170	65	1	NO	NO	3	T6	16	5	95	230	215	ADQ	260	60
9	DURAISAMY	16060	ILIZAROW fixation	B	53	M	160	65	1	NO	NO	3	T6	13	4	90	240	225	ADQ	300	60
10	SELVAKUMAR	25022	LL SSG	B	28	M	155	55	1	YES	YES	4	T6	14	5	90	210	200	ADQ	310	60
11	NAYAKAL	23372	Hemaroidectomy	B	46	F	150	50	1	NO	NO	3	T7	13	5	105	210	195	ADQ	320	55
12	GOVINDARAJ	18542	Fistulectomy	B	40	M	160	55	1	NO	NO	3	T7	14	4	105	230	215	ADQ	340	55
13	MUTHURAMALINGAM	24306	lat sphinterectomy	B	35	M	168	60	1	NO	NO	3	T8	15	4	100	220	215	ADQ	300	45
14	MALAIRAJAN	20723	Anal sph dilatation sphinterectomy	B	24	M	155	45	1	NO	NO	3	T7	14	5	100	225	215	ADQ	320	55
15	MOMAMETHA	26416	lat sphinterectomy	B	20	M	160	62	1	YES	YES	4	T5	14	5	85	240	230	ADQ	330	50

16	KANNAGI	27287	Hemaroidectomy	B	30	F	155	60	1	NO	NO	4	T6	15	5	90	210	195	ADQ	340	50
17	SHANKAR	32429	MED Gastronemius flap	B	36	M	170	75	1	NO	NO	5	T5	15	5	90	210	195	ADQ	320	55
18	CHELLADURAI	35393	EX fixation	B	35	M	165	60	1	YES	YES	2	T6	12	4	95	210	190	ADQ	310	75
19	CHINNAPANDI	27203	SSG	B	52	M	168	66	1	NO	NO	3	T6	12	4	95	215	210	ADQ	320	60
20	RAMU	38203	EXCISION of fem head	B	52	M	152	66	1	NO	NO	4	T7	13	5	100	215	195	ADQ	280	50
21	RANI	38203	ORIF with mal scrw	B	28	M	160	55	1	YES	YES	3	T5	14	4	95	230	210	ADQ	290	55
22	MUTHUKUMAR	29270	EX fixation	B	31	M	165	70	1	YES	YES	3	T4	13	4	105	230	220	ADQ	320	45
23	CHINNTHAMBI	38040	EX fixation	B	50	M	155	55	1	NO	NO	4	T6	14	5	100	230	215	ADQ	320	60
24	MALAICHAMY	41962	Implant removal	B	27	M	160	56	1	YES	YES	5	T7	15	7	90	190	175	ADQ	330	60
25	DURAISAMY	44737	Tension banding patella	B	20	M	158	60	1	NO	NO	4	T7	14	6	120	235	215	ADQ	340	60
26	KRICHNAN	40518	Hemaroidectomy	B	60	M	160	55	2	NO	NO	3	T6	14	4	100	230	215	ADQ	320	55
27	KULENDRAN	41369	Hemaroidectomy	B	45	M	155	56	1	YES	YES	3	T7	15	5	100	225	200	ADQ	320	60
28	manikandan	45345	Hemaroidectomy	B	42	M	163	68	1	NO	NO	3	T4	15	4	95	200	185	ADQ	340	60
29	prabu	78255	Hemaroidectomy	B	40	M	155	59	1	YES	YES	3	T6	14	5	95	230	210	ADQ	290	50
30	SRINIVASAN	78050	Hemaroidectomy	B	34	M	150	56	1	NO	NO	3	T6	15	4	155	240	220	ADQ	320	60
31	SARAVANAN	78358	Hemaroidectomy	B	46	M	165	58	1	YES	YES	4	T7	16	5	85	235	210	ADQ	320	55
32	Jothi	79205	Hemaroidectomy	B	50	F	150	52	1	NO	NO	5	T6	15	7	80	230	215	ADQ	330	60
33	PAULRAJ	78673	Hemaroidectomy	B	48	M	166	58	1	YES	YES	3	T6	14	4	100	200	185	ADQ	340	55
34	SUBRAMANIAN	43101	Implant removal	B	49	M	162	60	1	NO	NO	3	T8	16	4	90	180	165	ADQ	330	75
35	ALAGARRAJAN	34675	Tumor resection with knee arthrodesis	B	52	M	170	64	2	YES	YES	4	T4	14	6	110	190	180	ADQ	320	75
36	JEYAKUMAR	34682	TENDON REPAIR	B	54	M	165	66	1	NO	NO	3	T6	15	5	95	200	180	ADQ	310	55
37	KURUMBAN	42721	Petellectomy	B	55	M	167	60	1	NO	NO	3	T6	16	4	95	230	200	ADQ	310	60
38	ALAGARSAMI	42834	Revision amputation	B	55	M	164	59	2	YES	YES	3	T6	13	4	100	220	205	ADQ	300	60
39	ANANDAKUMAR	46586	REPAR OF Tendon of Achilies	B	38	M	150	55	1	NO	NO	4	T7	14	6	100	230	215	ADQ	340	60
40	IQBAL	49329	Biopsy and curretage	B	50	M	168	60	1	YES	YES	3	T6	14	4	105	240	225	ADQ	320	60
41	JEJAPRAKASH	28426	LL SSG	B	55	M	160	64	1	NO	NO	3	T5	13	4	75	240	215	ADQ	320	60
42	SARASWATHI	28330	lat sphinterectomy	B	34	F	150	52	1	NO	NO	3	T5	14	4	100	230	210	ADQ	330	60
43	PANDI	32845	Hemaroidectomy	B	35	M	165	65	1	YES	YES	3	T5	14	4	105	240	235	ADQ	340	55

44	PASUPATHI	39996	lat sphinterectomy	B	28	M	160	58	1	NO	NO	3	T4	15	4	100	220	205	ADQ	330	55
45	PITCHAIMANI	32484	lat sphinterectomy	B	35	M	168	65	1	NO	NO	2	T7	15	3	90	220	200	ADQ	330	45
46	POONGODI	82885	Hemaroidectomy	B	40	F	152	52	1	NO	NO	4	T7	15	5	90	190	170	ADQ	320	50
47	DHANALAKSHMI	38873	Hemaroidectomy	B	42	M	155	55	1	NO	NO	5	T6	15	6	95	230	210	ADQ	300	55
48	pandiamal	38878	Hemaroidectomy	B	50	F	154	58	1	NO	NO	3	T6	14	5	85	210	195	ADQ	310	55
49	VELUMANI	40828	Hemaroidectomy	B	35	F	166	70	1	NO	NO	3	T5	14	5	100	230	215	ADQ	340	55
50	SHANTHI	40863	Hemaroidectomy	B	45	F	152	55	1	NO	NO	2	T6	15	3	110	240	215	ADQ	330	55
51	BALAMURUGAN	50283	Tibia SCEW FIX	R	29	M	165	60	1	NO	NO	6	T10	16	10	65	160	140	ADQ	250	50
52	SUBBIAH	27247	SSG	R	50	M	168	56	2	NO	NO	6	T12	15	12	60	165	145	ADQ	240	60
53	HARIHARAN	42614	SSG	R	47	M	165	65	1	NO	NO	7	T10	15	10	55	175	150	ADQ	250	75
54	VIJAYAN	52874	Implant removal	R	32	M	155	60	1	YES	YES	7	T8	15	9	55	180	135	ADQ	260	75
55	CHELLPANDI	46249	EX FIX REALAINMENT	R	20	M	168	69	1	NO	NO	6	T10	16	10	60	165	165	ADQ	260	60
56	CHANDRAN	46691	Hemaroidectomy	R	43	M	160	65	1	NO	NO	7	T8	16	8	65	160	135	ADQ	260	45
57	RAJA	46727	Hemaroidectomy	R	20	M	160	68	1	NO	NO	8	T9	14	9	65	175	145	ADQ	240	45
58	SEVANNAMAL	48629	Hemaroidectomy	R	47	F	156	63	1	NO	NO	6	T10	15	10	70	180	140	ADQ	210	60
59	RAJENDRAN	45048	Hemaroidectomy	R	56	M	170	69	1	NO	NO	7	T10	15	12	55	155	130	ADQ	230	50
60	SARAVANAMANI	50624	Hemaroidectomy	R	20	M	158	54	1	NO	NO	8	T12	14	10	50	145	120	ADQ	240	55
61	ESWARI	50627	Hemaroidectomy	R	23	F	160	52	1	NO	NO	6	T8	15	9	70	165	145	ADQ	250	75
62	DHAKSHINAMURHY	51878	Hemaroidectomy	R	47	M	167	62	1	NO	NO	8	T9	16	8	60	175	155	ADQ	240	55
63	BALU	48740	Hemaroidectomy	R	47	M	168	70	1	YES	YES	7	T10	16	8	65	165	145	ADQ	200	55
64	SARASWATHI	56751	lat sphinterectomy	R	31	F	158	56	1	NO	NO	7	T10	14	9	65	175	140	ADQ	240	55
65	murugesh	58593	Hemaroidectomy	R	34	M	160	62	1	NO	NO	8	T12	13	9	55	180	150	ADQ	240	55
66	IBUTHAKAR	43941	SSG	R	29	M	168	65	1	NO	NO	7	T12	13	9	50	170	140	ADQ	250	50
67	MUTHALAGAN	51854	Implant removal	R	55	M	165	70	1	YES	YES	6	T8	14	9	70	155	135	ADQ	260	55
68	MUTHUMARIAMAL	48804	SSG	R	41	F	152	56	1	NO	NO	6	T10	15	10	65	185	160	ADQ	260	55
69	KANAGAVEL	55088	ILIZAROW fixation	R	33	M	168	68	1	NO	NO	6	T10	14	10	60	160	150	ADQ	240	60
70	RAMAN	57396	WOUND DEBRIMA WITH AB beading	R	20	M	165	64	1	NO	NO	7	T9	15	10	45	145	130	ADQ	260	75
71	RAMAKRISHNAN	53850	ak amputation	R	40	M	158	55	1	NO	NO	5	T10	17	9	60	150	130	ADQ	240	60
72	MURTHY	49931	Revision amputation	R	44	M	150	62	1	NO	NO	6	T10	15	9	65	180	165	ADQ	230	50

73	ANGAMMAL	45688	FILAP COVER	R	48	F	158	55	1	NO	NO	6	T10	14	11	65	155	140	ADQ	220	55
74	PUSHPAM	57870	EX fixation	R	50	M	165	50	1	NO	NO	6	T12	15	10	55	150	145	ADQ	240	75
75	krishnan	63784	Implant removal	R	48	M	162	58	1	NO	NO	6	T10	15	10	55	165	145	ADQ	230	50
76	ARUMUGAM	55037	EX fixation	R	56	F	154	58	1	NO	NO	7	T10	13	10	45	155	145	ADQ	220	55
77	SIVAKUMAR	60165	Frac talus BLAIR FUSION	R	32	M	164	60	1	NO	NO	5	T10	12	8	60	180	160	ADQ	230	75
78	SIVA	64982	Revision amputation	R	20	M	168	62	1	NO	NO	7	T12	15	10	45	120	100	ADQ	250	55
79	MUTHU	55516	SSG	R	38	M	158	60	1	NO	NO	6	T9	14	11	70	130	120	ADQ	260	60
80	SETHURAMAN	58892	Hemaroidectomy	R	30	M	162	65	1	NO	NO	8	T9	13	10	55	150	135	ADQ	270	45
81	MOOKIYA	58892	Hemaroidectomy	R	40	M	158	60	1	NO	NO	7	T10	14	10	45	160	145	ADQ	230	45
82	KANNAN	60219	lat sphinterectomy	R	40	M	160	62	1	NO	NO	6	T10	14	8	60	175	150	ADQ	220	45
83	MUTHARAMMAL	62809	lat sphinterectomy	R	22	M	158	55	2	NO	NO	6	T12	15	8	60	160	140	ADQ	230	55
84	ALAGU	62774	Hemaroidectomy	R	55	F	155	52	1	NO	NO	6	T10	15	8	60	160	135	ADQ	240	55
85	MOOKAN	66043	Hemaroidectomy	R	50	M	162	60	1	NO	NO	7	T12	16	9	65	165	150	ADQ	250	55
86	SELVI MARY	65925	lat sphinterectomy	R	58	M	168	65	1	NO	NO	5	T9	13	9	70	175	165	ADQ	260	60
87	JEYAKUMAR	65998	Hemaroidectomy	R	30	F	154	51	1	NO	NO	6	T8	13	10	165	165	150	ADQ	230	55
88	BABU	67685	lat sphinterectomy	R	23	M	162	62	1	NO	NO	5	T10	15	9	150	160	140	ADQ	240	50
89	OCHAKAL	67799	Hemaroidectomy	R	34	M	163	58	1	NO	NO	4	T10	13	10	75	155	135	ADQ	240	50
90	SHANMUGAABIR AMI	67742	Hemaroidectomy	R	58	F	155	54	2	NO	NO	6	T12	16	8	75	170	150	ADQ	240	45
91	CHANDRAN	71129	Hemaroidectomy	R	53	F	156	54	1	NO	NO	6	T10	16	9	50	140	130	ADQ	230	45
92	KALLIMUTHU	72811	Hemaroidectomy	R	52	M	170	64	1	NO	NO	8	T8	15	10	60	120	100	ADQ	240	45
93	BASKARAN	72944	Hemaroidectomy	R	42	M	163	58	1	NO	NO	7	T8	14	10	65	190	175	ADQ	250	45
94	MD YUSUF	75054	Hemaroidectomy	R	28	M	168	65	1	NO	NO	6	T10	14	8	65	165	150	ADQ	250	45
95	VALLIAN	74081	Hemaroidectomy	R	48	m	155	52	1	NO	NO	7	T10	16	9	55	185	160	ADQ	250	55
96	ARUMUGAM	65130	Hemaroidectomy	R	55	M	165	65	1	NO	NO	7	T12	15	9	55	185	155	ADQ	220	75
97	BALAKRISHNAN	67939	Implant removal	R	39	M	168	65	1	NO	NO	6	T10	15	8	50	165	155	ADQ	220	60
98	MURUGESAN	60118	SSG	R	60	M	160	62	1	NO	NO	6	T10	15	12	60	165	145	ADQ	240	60
99	MURUGAN	49497	FLAP COVER	R	21	M	166	65	1	NO	NO	4	T10	20	8	75	145	125	ADQ	240	75
100	VISUVASAM	41147	Hemaroidectomy	R	50	M	165	56	2	NO	NO	7	T12	15	9	45	170	150	ADQ	250	50

		PULSE RATE																		SYSTOLIC BLOOD PRESSURE																	
S.No.	Group	PREOP	2MIN	4MIN	6MIN	8MIN	10MIN	15MIN	20MIN	25MIN	30MIN	35MIN	40MIN	45MIN	50MIN	55MIN	60MIN	75MIN	90MIN	PREOP	2MIN	4MIN	6MIN	8MIN	10MIN	15MIN	20MIN	25MIN	30MIN	35MIN	4OMIN	45MIN	50MIN	55MIN	60MIN	75MIN	90MIN
1	B	86	86	84	84	84	80	78	78	78	75	74	74	72	74	74	74	70		126	124	126	126	124	120	120	120	124	116	116	116	114	114	116	110	120	
2	B	100	100	98	88	93	95	84	84	84	86	80	86	90	89	86	90			138	134	134	136	136	130	130	130	138	134	138	134	130	128	124	120		
3	B	76	76	75	76	74	72	72	74	72	70	70	72	72	70	72				112	114	110	110	98	98	98	100	102	106	99	98	112	114	112				
4	B	86	87	86	85	76	75	75	80	87	76	72	87	88	90					120	120	120	118	116	116	118	110	110	100	102	116	118	118					
5	B	76	74	73	76	72	65	64	63	64	76	80	87	78	87					130	130	128	130	132	120	112	120	118	118	120	130	120	124					
6	B	85	78	78	77	74	72	78	60	64	62	62	67	76	78	90				120	120	124	118	116	112	110	118	120	118	114	116	112	112	120				
7	B	80	80	76	78	78	80	80	76	74	72	76	77	87	90	93				124	126	120	120	120	124	120	118	112	110	106	108	104	116	120				
8	B	74	75	78	79	80	76	75	74	73	67	66	63	78	89	87	89			140	140	138	134	120	120	126	130	120	130	130	130	126	120	112	118			
9	B	76	78	79	67	67	64	65	67	67	76	76	87	78	78	89	91			130	130	132	122	120	118	116	118	116	112	110	106	108	102	112	118			
10	B	90	89	85	86	76	68	66	68	62	60	62	62	62	65	76	78			134	130	130	124	120	112	110	94	96	86	108	110	106	100	110	124			
11	B	100	98	99	96	77	87	85	88	94	98	93	98	99	103	109				110	110	110	108	110	106	98	98	100	102	104	102	109	112	110				
12	B	78	79	76	76	75	65	64	62	74	78	80	80	82	81	88				130	130	120	124	124	120	118	116	112	118	120	120	124	120	128				
13	B	98	98	97	90	89	82	83	83	84	85	86	90	87	88					130	126	126	130	120	118	118	110	120	122	126	128	130						
14	B	75	76	76	75	74	73	72	72	69	67	66	64	63	63	62				120	120	120	120	124	118	118	118	112	110	108	108	106	110	116				
15	B	92	90	92	90	89	88	88	68	70	56	94	97	95	98					124	124	124	122	120	116	100	98	98	86	100	110	116	116					
16	B	90	87	89	87	82	83	83	84	89	86	88	88	87	89					118	116	118	120	110	110	112	112	114	116	110	118	120	122					
17	B	78	76	75	76	73	72	71	71	69	66	63	62	77	78	88				140	140	134	134	130	134	130	120	124	124	128	128	122	120	124				
18	B	74	74	74	76	78	82	60	56	80	78	88	78	89	98	88	86	82		134	134	132	132	134	114	110	86	100	110	112	120	120	124	138	140	132		
19	B	87	87	86	86	80	80	76	65	66	62	76	78	79	79	82	83			110	110	112	108	108	106	102	100	98	98	98	100	102	112	120	120			
20	B	87	64	87	98	93	87	77	72	73	75	75	76	78	78					120	120	124	122	122	12	118	116	112	110	112	102	100	112		124			
21	B	87	87	88	88	88	82	80	70	55	76	80	80	83	82	89				120	120	124	112	110	106	110	102	100	86	110	112	116	106	106				
22	B	86	88	76	86	88	76	80	76	78	88	88	87	95	98					126	126	112	106	98	98	82	110	108	116	120	116	132						
23	B	80	78	77	79	80	89	77	78	67	67	68	77	78	73	78	69			118	118	116	116	118	116	110	108	104	102	106	108	110	120	120	124			
24	B	102	100	98	98	98	88	78	78	54	76	76	76	78	89	89	90			112	12	116	108	104	104	108	100	86	110	112	112	108	108	108	110			
25	B	87	87	89	89	88	87	86	85	84	83	87	78	78	78	67				123	130	124	124	120	112	114	126	112	110	108	106	104	118	116				
26	B	76	76	78	75	74	73	72	72	74	66	65	65	63	62	74	78			120	120	120	120	116	116	112	110	110	108	116	118	120	122	120	126			
27	B	89	88	88	80	80	78	65	66	56	80	76	76	76	86	88	86			130	130	126	128	108	100	92	92	86	112	118	114	116	112	120	120			
28	B	72	72	70	71	78	62	66	65	66	67	63	70	72	76					112	112	110	110	110	108	108	106	106	108	110	112	112	114					
29	B	100	100	102	102	89	98	87	88	70	54	77	70	80	88					128	128	124	122	110	110	112	98	88	106	110	112	120	120					
30	B	87	78	78	76	75	74	73	72	72	70	70	76	66	67	78	88			120	120	120	118	118	116	116	114	114	114	112	112	120	122	124	124			
31	B	92	92	90	90	85	82	80	78	68	65	58	78	80	77	78				136	134	130	130	124	124	122	112	100	98	88	112	188	128	130				

32	B	75	75	74	73	73	72	67	68	65	64	63	67	78	78	79	80			120	120	116	118	118	118	118	116	112	112	110	110	110	100	98	124		
33	B	76	78	75	72	72	70	74	62	55	77	89	89	90	87	87				124	124	126	112	108	108	106	94	86	106	118	120	118	118	118			
34	B	70	73	72	73	76	76	76	78	78	78	89	89	90	90	92	95			120	120	112	114	120	120	120	120	112	120	120	118	120	120	124	120		
35	B	100	100	90	89	88	62	77	63	59	94	98	99	99	100	102	108	102		132	132	130	110	108	102	100	100	98	94	88	100	112	120	122	124	120	
36	B	72	72	73	70	65	66	66	65	63	67	68	70	72	74	76				130	130	124	124	122	110	112	120	112	112	110	118	110	100	114			
37	B	86	86	84	83	83	81	87	76	76	66	65	64	63	68	70	78			118	118	116	116	114	110	108	112	120	120	118	112	118	120	120	124		
38	B	88	88	89	84	83	81	80	76	64	54	78	80	77	76	77	78			110	112	116	108	106	108	99	99	88	110	110	112	98	98	110	108		
39	B	70	70	70	67	65	65	60	62	67	68	69	70	72	73	73	78			120	120	120	118	118	116	116	114	112	100	102	100	98	100	112	120		
40	B	102	98	98	100	102	88	78	67	55	87	98	98	108	110	110	112			128	128	118	110	108	102	98	98	86	114	112	126	128	128	130	130		
41	B	80	80	78	78	79	76	74	71	70	76	87	74	72	72	73				120	112	114	114	120	120	120	112	110	112	112	110	108	110	112	120		
42	B	76	76	74	72	70	70	72	67	68	65	65	65	67	70	71	72			134	130	130	124	124	124	130	120	120	112	128	122	120	120	118	118		
43	B	78	78	75	78	78	67	86	78	80	87	89	76	68	66	67	78			134	126	124	128	128	122	104	108	108	112	108	120	124	128	112			
44	B	78	76	78	77	67	60	65	62	61	62	68	78	78	79	80				110	110	110	108	110	112	108	102	102	100	98	100	110	112	116			
45	B	74	74	76	76	78	78	79	72	70	65	63	60	71	70					114	112	114	110	110	110	108	112	106	108	112	110	110					
46	B	80	80	82	82	80	82	80	78	76	75	75	70	66	65	66				122	124	124	120	118	114	110	110	112	110	110	112	116	120				
47	B	76	76	75	75	74	76	78	77	80	76	76	76	74	73	66	64			130	130	124	126	116	110	102	108	108	110	110	112	120	124	130			
48	B	80	78	78	76	66	65	64	66	77	76	76	75	70	65	67				128	128	124	124	120	112	116	118	114	114	116	118	112	120	120			
49	B	76	78	78	78	80	80	82	67	67	66	65	77	78	78	79				122	122	122	124	120	112	118	120	120	124	126	132	130	132	130			
50	B	78	78	78	80	67	66	78	78	67	89	99	90	78	76	74				124	124	126	118	114	114	112	112	104	112	110	108	112	114	120			
51	R	90	90	90	90	88	88	84	84	82	82	80	78	78	78	76	80	86		134	134	132	124	122	122	120	112	110	106	102	100	104	110				
52	R	87	87	86	86	78	77	76	76	75	76	76	76	70	78	66	70			120	120	120	118	116	116	112	112	110	108	106	104	110	112	114	120		
53	R	80	80	78	78	76	76	80	82	82	80	80	76	75	75	67	67	66		110	112	112	114	116	112	110	110	110	110	108	104	112	112	118	120	122	
54	R	76	76	78	66	72	72	64	64	58	80	86	76	76	88	90	92	92		134	130	120	106	120	120	100	98	88	116	116	112	120	130	124	124	130	
55	R	78	78	76	76	75	70	66	64	67	77	78	67	89	89	77	78			120	120	120	120	120	120	112	112	110	106	108	110	110	110	118	120		
56	R	87	88	86	84	84	80	78	78	76	75	70	68	70						124	124	120	112	112	116	118	118	112	112	110	120	120					
57	R	88	88	86	87	87	86	80	78	76	76	70	67	77						124	124	120	118	118	112	114	110	110	114	114	110	110					
58	R	98	89	78	78	76	76	78	78	74	76	79	66	68	70					120	120	120	116	118	116	116	110	110	112	112	110	106	108	110	110		
59	R	90	86	87	87	86	85	85	70	78	78	76	87	90	92	95				110	110	110	108	104	100	106	108	110	110	110	110	112	112				
60	R	92	90	89	89	88	87	87	76	76	78	79	80	82	80	82	84			110	112	112	110	108	105	104	104	100	112	112	114	116	118	110			
61	R	77	78	77	76	74	74	72	70	70	67	68	68	70	76	78	80	76		120	124	120	118	118	112	112	114	116	112	110	110	100	106	104	112	120	
62	R	78	76	76	76	70	70	67	68	67	60	63	63	65	65	76				130	124	124	130	122	124	120	118	114	112	110	112	120	128	130			
63	R	77	78	78	72	70	68	64	67	54	78	80	78	92	90	89				124	124	124	120	120	108	100	96	88	110	118	112	128	124	124			
64	R	77	76	75	74	76	66	67	60	62	60	67	68	78	73	79				124	124	124	120	120	110	110	106	108	110	10	118	120	120	120			
65	R	78	76	75	74	74	75	76	78	66	65	62	74	74	75	80				124	120	120	120	120	110	110	108	108	106	104	110	118	114	120			
66	R	78	78	76	73	74	67	62	60	67	67	78	72	74	76					120	120	120	118	116	116	112	114	116	112	110	110	108	110				
67	R	98	100	102	98	76	67	67	62	60	52	80	82	82	84	94				134	130	124	120	112	102	108	100	86	100	100	118	112	120	120			

68	R	82	86	80	80	82	78	76	72	70	65	66	70	76	80	90				120	120	120	120	124	118	118	116	116	116	118	118	116	110	112			
69	R	80	87	86	82	80	78	67	68	62	79	80	90	92	99	100	100			120	120	120	120	118	112	112	110	108	110	110	110	110	112	120	120		
70	R	78	76	73	87	85	65	78	80	88	90	100	106	110	90	98	96	100		120	120	120	120	112	112	112	116	118	112	112	114	114	112	118	120	120	
71	R	89	89	84	87	87	86	89	89	76	75	74	66	62	67	78	90			124	120	120	126	124	124	112	118	118	110	120	126	130	130	124	120		
72	R	70	70	70	89	82	78	74	74	76	76	80	87	86	78					120	120	118	118	114	114	112	112	114	116	118	118	120	120				
73	R	75	74	74	76	74	72	72	65	76	73	72	80	89	89	80				140	120	118	116	114	114	112	112	112	112	108	108	110	112	112			
74	R	78	78	76	76	74	74	76	70	67	68	68	80	78	82	82	90	98		118	120	118	###	116	114	114	112	112	112	112	118	116	116	118	122	122	
75	R	79	78	76	66	66	64	64	60	76	77	78	80	89	84					120	120	120	118	116	116	114	114	112	112	112	112	112	112				
76	R	89	72	76	76	75	75	87	98	98	98	110	100	108	106	110				110	110	108	108	104	100	100	100	98	98	98	98	98	110	110			
77	R	87	77	78	76	78	76	75	73	72	71	67	67	78	78	89	89	90		126	124	120	120	120	118	116	112	112	116	118	118	110	120	124	130	130	
78	R	76	75	76	80	82	82	84	87	88	89	90	90	94	100	98				120	136	136	130	130	130	132	124	122	120	118	112	110	118	120			
79	R	78	76	74	78	83	88	89	90	97	98	100	110	109	110	112	98			128	124	124	120	118	116	110	120	112	118	116	118	120	120	122			
80	R	84	82	80	86	83	82	90	94	94	98	96	99	93						130	130	130	130	124	120	120	120	118	118	116	112	110					
81	R	80	80	78	80	80	80	83	84	85	90	90	96	94						120	120	120	118	116	116	110	120	120	120	120	114	112					
82	R	80	80	80	78	79	65	76	89	78	78	89	98	99						110	108	110	106	112	110	102	100	98	98	100	112	116					
83	R	80	78	77	79	87	86	84	85	82	88	90	87	87	85	90				112	112	112	112	110	110	110	106	106	102	100	108	102	110	110			
84	R	74	74	72	88	98	100	89	90	93	94	94	88	89	85	89				116	116	116	112	112	112	110	110	110	104	106	102	100	110	110			
85	R	75	75	73	87	88	80	82	80	82	84	86	88	89	90	98				128	126	126	126	124	124	122	122	120	120	114	110	110	112	112			
86	R	76	76	76	78	80	88	88	89	80	93	95	98	98	100	102	105			112	130	130	126	126	128	120	112	110	110	110	108	110	112	112	112		
87	R	78	78	77	80	77	78	87	80	80	80	85	88	88	89	90				120	124	120	118	112	110	108	110	110	116	116	116	116	112	120			
88	R	78	78	78	78	80	80	83	82	80	82	82	80	88	90					118	118	118	114	112	110	112	110	108	106	100	110	114	120				
89	R	67	66	67	77	78	78	79	80	87	90	94	92	90	90					120	120	120	120	116	114	110	110	108	106	104	110	112	112				
90	R	78	77	77	89	78	65	65	76	76	87	80	93	95	98					120	120	120	116	116	12	112	112	110	110	112	112	102					
91	R	72	67	78	80	88	89	76	66	89	90	90	92	99						120	120	118	118	120	120	120	116	112	112	110	112	110					
92	R	78	77	84	80	78	78	72	70	75	76	78	78	78						130	124	124	122	120	120	118	118	112	110	110	128	120					
93	R	91	86	87	78	87	87	80	82	99	100	109	98	88						120	120	120	122	122	116	112	112	108	104	106	100	100					
94	R	99	98	87	80	82	83	84	85	78	88	98	90	98						110	108	108	110	108	100	100	98	100	98	104	106	110					
95	R	89	87	86	84	87	80	80	78	78	76	72	70	87	88	90				124	124	124	120	120	120	124	120	120	116	116	120	120	112	112			
96	R	78	79	78	89	78	89	88	78	74	76	77	87	98	89	100	98	90		128	128	126	126	126	122	120	120	116	116	112	116	118	120	120	112	120	
97	R	88	80	76	78	89	89	90	94	89	90	99	100	89	96	87	90			124	124	120	120	120	116	116	112	114	110	108	100	112	112	118			
98	R	89	88	76	78	78	80	82	85	86	88	87	86	80	88	90	78			122	120	120	122	120	114	112	110	114	114	112	100	102	104	106	110		
99	R	72	70	74	78	78	78	74	75	76	77	78	78	62	65	67	78	88		122	120	120	122	120	116	116	112	112	110	110	110	112	112	118	120	122	
##	R	76	78	78	78	88	90	90	98	86	93	90	89	89						134	132	132	130	132	132	###	126	120	120	120	118	120	120				

DIASTOLIC BLOOD PRESSURE																		SPO2																	
PREOP	2MIN	4MIN	6MIN	8MIN	10MIN	15MIN	20MIN	25MIN	30MIN	35MIN	40MIN	45MIN	50MIN	55MIN	60MIN	75MIN	90MIN	PREOP	2MIN	4MIN	6MIN	8MIN	10MIN	15MIN	20MIN	25MIN	30MIN	35MIN	40MIN	45MIN	50MIN	55MIN	60MIN	75MIN	90MIN
82	84	84	82	82	80	80	80	78	78	78	74	74	72	74	74	76		100	100	100	100	100	99	100	100	100	100	100	98	99	100	100	100	100	
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78	76	67	72	68	72	66	76	74	72	72	70	70	70	74				99	99	98	98	99	99	98	98	98	99	97	98	99	99	99			
80	80	76	78	70	72	74	76	74	68	68	72	72	74					100	100	100	100	100	100	100	100	99	100	100	100	100	99				
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